British Society for the Study of Orthodontics.

1916-20.

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TRANSACTIONS

OF THE

British Society for the Study of Orthodontics.

1916—1920

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ORDINARY MEETING.

An Ordinary Meeting of the Society was held at 11, Chandos Street, Cavendish Square, W., on Wednesday, March 8th, 1916, Mr. J. E. Spiller, President, occupying the chair.

The President delivered the Presidential Address:

"Orthodontics in Peace and War."

In succeeding to this chair, which my distinguished predecessors have adorned with their wealth of knowledge and experience, I thank you very sincerely for the honour you have accorded me. I am deeply conscious that my qualifications to act as your president are very limited, and admit, as in confidence to friends, that I might be happier in a less exalted position, but relying on your indulgence for my deficiencies, I shall face my duties with confidence and courage.

In the middle of the second year of the greatest war of history the relative importance of the science and art of orthodontics may appear very insignificant, and it has been suggested that our meetings should be abrogated until happier times. But we are in name, and I believe no less in fact also, a society of students, and I think your Council has acted wisely in deciding that a reduction of the number of meetings is the desirable measure to adopt, and indeed it would not be difficult to justify their decision on several hypotheses. For example, it is generally conceded that the importance of scientific knowledge and investigation in every useful sphere was never greater than at present, and that is a proposition which it is unnecessary for me to elaborate.

But I believe that the convincing evidence of the present practical importance of the study of orthodontics is seen in two directions, viz., in the relation of orthodontics to the physical welfare of the rising generation, and in its relation to the efficient treatment of war injuries of the jaws.

It is an aphorism that the chief hope for the future of orthodontics lies in the prevention of malocclusions. We have every reason to believe—I think it is correct to say that we know—that a very large proportion of cases could be prevented by the establishment of certain measures from earliest infancy, in particular by correct methods of feeding and breathing. And it should be observed that the reversion to correct or natural habits would not only prevent a large percentage of dental irregularities; they are now largely recognised as the ideal preventatives of dental caries and many forms of oral sepsis, in addition to numerous general disorders, and would, of necessity, contribute very materially to the physical improvement of the race.

But if many cases of malocclusion may definitely be classed as preventible, there is still a large residuum, concerning the ultimate ætiology of which we are in partial or complete ignorance. Some of these are attributed to an inherited origin and others to a perverse development of osseous tissues. Invaluable contributions to their study have been given at meetings of this Society and the papers of Prof. Arthur Keith and Mr. Norman Bennett, amongst others, merit the closest study.

Next to prevention our ideal must be the attainment of the best results of treatment by the simplest methods, and this usually connotes early treatment.

Here then are the facts of importance—the possibility of prevention and the necessity of early treatment, and if our knowledge is to be extended to the advantage of the many, the moral is clear. Let there be no modest concealment of this knowledge, small as it may be. Parents do not know—in general they do not begin to know—the correct way to rear their children. The possible results of educational work in this direction cannot easily be estimated, but we all, either as teachers, or in our daily work, may assist in its advancement.

Incidentally we must regret that the work of school dental clinics has in many instances been discontinued, as we must regard this work as a small thing, but of national importance.

Perchance, among the social reforms for which we hope when peaceful times return, the Utopian ideals for the prevention and treatment of malocclusions may find a full measure of state or municipal recognition.

The relation of orthodontics to the treatment of war injuries of the jaws is at present of practical importance in so far as their prosthetic treatment is concerned. For, if it be true that the final restorative appliance is an elaborated denture, it is undoubtedly correct that the first and intermediate ones are modified or adapted appliances of regulation or retention.

And further, the mechanical principles involved in their use are in many cases identical. One need only mention the varied modifications of the expansion plate or the uses of intermaxillary traction as examples. A thorough knowledge of the principles of orthodontics cannot fail to be a valuable asset to those engaged in their treatment, but in view of the subject of to-night's discussion, observations on details would be superfluous.

When we consider what degree of amelioration of the distressing cases of jaw injuries might be obtained if the authorities made adequate use of our profession, we cannot fail to regret that so little has hitherto been accomplished. In this and in the larger sphere of military dental work let the service of men of proved ability and experience be chosen. Then, with efficient organisation and the opportunity of well-timed co-operation, we need have no misgivings that their work will not be accomplished in a manner redounding to the credit and honour of the profession, and contributing in no small degree to the relief of many of the wounded men of our fighting services.

On the proposition of Mr. George Northcroft, seconded by Mr. Lewin Payne, a hearty vote of thanks was accorded to the President for his able address.

MR. MORRIS' "LATCH" DEVICE.

FRACTURE OF THE MANDIBLE.

Simple Fracture.

Fig. A1.

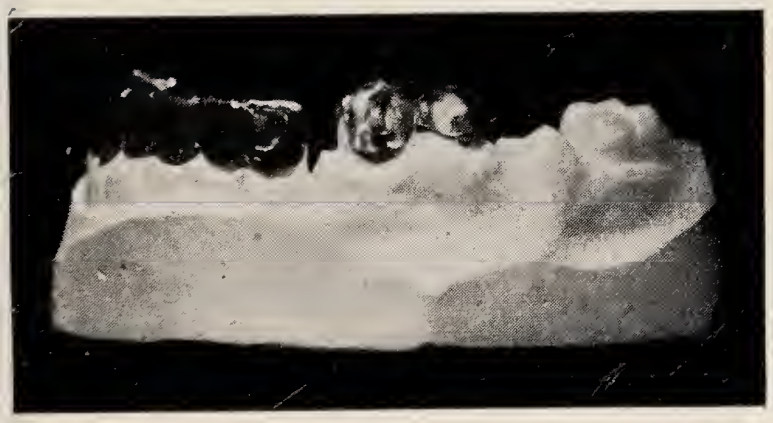


Fig. A2.

Fig. A3.

Compound Fracture.

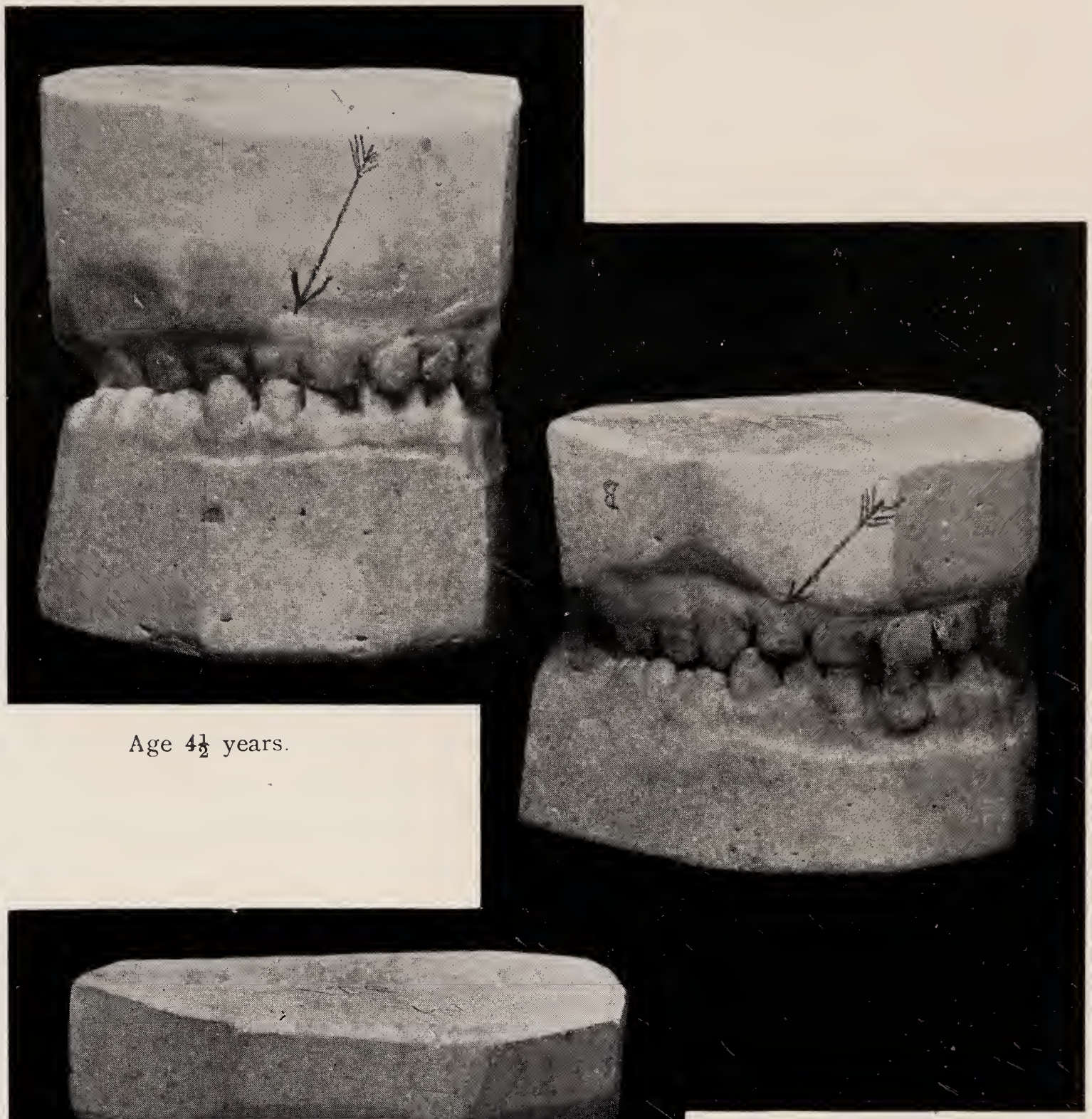
Fig. B1.

Fig. B2.

Fig. B3.

ILLUSTRATING MR. A. E. ROWLETT'S REMARKS.

The Treatment of a Contracted Arch Deciduous Dentition.



Age 4½ years.

Age 4¾ years.

Age 9 years.

Illustrating Mr. B. Maxwell Stephens' Communication.

The Treatment of a Contracted Arch, Deciduous Dentition.

By Mr. B. Maxwell Stephens.

I started to treat this case at the age of 4½ years. There was little direct work in the way of expanding the arch, just bringing out a lateral and canine to enable the occlusion to improve. The models speak for themselves. In many cases there is a tendency, if the upper arch is not spreading normally, for the mandible to slew round, giving the impression on one side of the mouth that the occlusion is post-normal, while the six-year-old molars on the other side remain in normal occlusion. Sometimes a little expansion will enable the mandible to slip back into correct occlusion. In this case I merely pegged out the upper lateral and canine. The first model shows the condition at the age of 4½ years, and the second the condition after three months' treatment. I did not see the child for a little time, and when I did I put in a Badcock expansion plate. The third model shows the condition at present. I have not quite concluded the case; the lower arch still requires expansion. The child's face was becoming asymmetrical, and, as the child was very pretty, those around her, noticing the change, were greatly distressed. Now the treatment had practically restored the symmetry.

The President said the communication appeared to emphasise the old adage that "a stitch in time saves nine." Very often only moving one tooth prevented a habit or irregularity from becoming permanent, and that seemed to be what Mr. Maxwell Stephens had accomplished. Early treatment was very desirable when possible. The question of early treatment, when it concerned a big change, such as treating post-normal occlusion, was a little different, but when it was possible to move a tooth or two and get a good result, early treatment was most desirable.

Mr. J. H. Badcock said the case was particularly interesting to him as proving that there was a "bite of convenience," and that some little alteration might put it right. He had always doubted more or less how much a "bite of convenience" was a reality, but he believed the present case had convinced him that there was such a thing.

Mr. Maxwell Stephens said at the time he started the case, it was the first he had treated at that early age, and he adopted the old method of a peg and plate, which worked very well. Since then Mr. C. S. Morris had brought out a little device in which he fixed studs in the lingual surfaces of two opposite temporary molars, and springs on either side of a plate to slip under them, which was very useful. He had kindly sent a specimen for the Society to see, and it would be placed in the Museum.

The President said the device was known as the "Morris' Latch."

Mr. Northcroft said he had not found it necessary to use both latches. Fixing the plate under a peg on one side and latching it on the other side was quite sufficient to hold the plate rigidly in position. He believed Mr. Morris had modified his invention to that extent.

Orthodontic Methods in the Treatment of Fractures of the Jaws.

By Mr. Norman G. Bennett.

Our genial Honorary Secretary undoubtedly has a great capacity for persuading people to do what they have no desire to do! It is generally found that when people do what they do not want to do they do it very badly, and I now propose to exemplify the truth of that maxim. The first point that occurred to me in thinking out

what I ought to say in opening this discussion was what was meant by "Orthodontic Methods." Does it mean the principle of orthodontic methods, or the apparatus that is generally used? I take it that we are concerned with the latter; at any rate, so far as the principle of orthodontic methods goes, that means the gradual attainment of the end that we have in view, and, so far as fractures are concerned, it excludes methods which involve the immediate replacement of the parts in their proper position, and the holding of them in those positions, because that would only correspond with those orthodontic methods of immediate translation, which I presume is hardly intended. We are concerned therefore with gradual processes, and for my part the more I have to do with fractured jaws the more I incline to gradual methods rather than immediate, and, if that be the experience of others, we may expect more and more to find orthodontic appliances generally useful. It is customary to divide orthodontic appliances into removable and fixed, and I will consider them in that order. As regards removable appliances, far and away the most useful I have found is the ordinary double expansion screw known as the Badcock screw. In dealing with fractured jaws, we are dealing perhaps with a resistance—especially in those cases that arrive late—that is greater than that which we meet with in orthodontics; at any rate, if the resistance is not greater, the transverse strains on the apparatus are greater, and I think we need, when using expansion screws, to use them considerably larger and stronger. Mr. Hopson first suggested to me the use of these screws and I have used them pretty considerably in a good many cases. The cases to which I think they are most applicable are the examples of fracture which, in my experience, are the most common, that is to say, fracture in the premolar region, where there is usually considerable loss of bone. In those cases, after a very short time, the larger fragment swings round and deviates considerably across the middle line. In those cases I have tried methods which are not strictly orthodontic—expansion screws on fixed splints. I have also tried separating them and putting them in position and holding them there, and on the whole I think that the gradual separation of the parts, possibly not too soon after the immediate injury, but after some amount of callus has formed, is best, and I find the screws very useful for that purpose. They separate the parts as gradually or as rapidly as may be desired, and they hold them there when they have expanded sufficiently until such time as one can put on some form of fixed apparatus. The only defect I have found is that they tend, as it were, to drive down, and they need some form of partial capping of some of the teeth, the molar teeth especially, to prevent that. As an alternative to the double screw, one may use a Coffin spring or a modified Coffin spring, but it always seems to me that the use of a spring in that way is less under control than the use of a screw. Other forms of removable apparatus may be useful, but personally I have not tried them. I have not found any use for ordinary steel or gold springs. As regards retention by removable apparatus, clearly a simple vulcanite splint, corresponding very closely to the sort of vulcanite plate sometimes used for retention after orthodontic treatment, is useful.

Turning to fixed apparatus, the first kind that occurs to me is the old method, suggested by Angle, of bands with studs, formed so that the studs may be wired together. The prime use of this, of course, is intended to be the wiring together of the two jaws, fixing the mandible, and it is useful, or intended to be useful, in fractures behind the last tooth, fractures of the angle or of the ascending ramus. Personally I do not believe in immobilizing the mandible at all, except in a very small minority of cases, and only for very short periods. I have adopted the method of immobilising the half mandible, and I think those are the only cases in which it is justified—when you are dealing with only about half the jaw, and the other half consists of a large open

wound. You are then helping the patient by making him more comfortable, whereas if you immobilise a more or less complete mandible, you are making him supremely uncomfortable. Nevertheless, I am inclined to think that even in cases like those, cemented caps on the upper and lower are perhaps simpler and better than bands with studs. The method of bands with studs is also used, I believe, in the mandible. I have not tried it, and I cannot conceive how, when there is a loss of bone, the method will serve to keep the parts in tolerable position. The ordinary orthodontic method of bands on the molar and a bow and wiring is undoubtedly applicable to some of these cases ; I believe Mr. Hern has used it with success. I have not had any which I thought were quite suitable for it, but I can quite conceive, especially where the damage is great and the loss of bone is considerable, and the fracture perhaps is double or even treble, it may be a very good way, if the molars are firm, of placing the loose parts in position and retaining them there.

Another use of fixed bands is, of course, for the application of intermaxillary force, which is useful particularly in the case of fracture of the angle or ascending ramus, where the whole jaw swings round towards the injured side, or for cases of fracture in the premolar region. There again I am not convinced that bands are best ; I think that some form of cemented cap, not necessarily covering the crowns of the teeth, is better. Such caps hold perfectly well, and you can arrange the intermaxillary force by placing studs in the position wanted, to do exactly what is required, and bring the jaw round towards the middle line in a very short time.

With regard to the question of retention, here I think perhaps orthodontic methods are particularly useful. Take, for example, a case of fracture of the angle, where the deviation has been corrected and it is desired to maintain the jaw in that position and limit lateral movements. In that case perhaps the best way is to make a sort of buccal slide, sometimes single and sometimes double in the upper, and you may have a flange on the lower which fits into the double one on the upper, and thus prevent deviation in either direction. It may be assumed that, having corrected a deviation towards the injured side, it is sufficient to prevent it swinging back again towards that side, but that is not so ; paradoxical as it may appear, after the cases have been corrected, when the occlusion is normal with the mouth shut, when the patient opens the mouth the jaw sometimes deviates away from the injured side. I do not know what the explanation is, but it is a fact, and therefore it may be necessary to limit the movement to a hinge movement. For that purpose I think the bands form the simplest and most secure method of fixation, probably better than any form of cemented cap.

The disadvantage of bands is, of course, that the strain is placed on a few teeth rather than upon many, but where you only desire to retain the parts in the position in which you have placed them, and which they are more or less willing to adopt after a period of resistance to the forces which have been applied, there is no great strain, and I think bands form a neater method of retention than cemented cap splints of any kind. The best method is to make bands for a sufficient number of teeth and connect those bands together by thin wires on the buccal or lingual aspect, or both, and thus make a very strong splint, which will fit on easily and which is cleanly. As regards the gap, that, of course, can be kept of the right size by wires placed crosswise, that is to say, proceeding from the buccal aspect at the one end to the lingual aspect at the other, and *vice versa*, so that they cross in the middle and can be soldered at the crossing point. In that way you get a very strong, but very light splint which serves its purpose admirably.

Mr. H. Baldwin said that when he was in France he did not see any work that surpassed or equalled the work of Dr. Frey in ingenuity

and beauty of workmanship, and he had heard Dr. Frey say that if he had not been an orthodontist he would not have been able to do the work he was doing for jaws. With regard to the use of a jack-screw for the purpose of expanding the two sides of the fractured lower jaw, he had seen in various places and in various publications illustrations of jack-screws absolutely fixed at each end into the trough splint covering the teeth. Such illustrations ought to disappear from the literature, because a jack-screw so fixed could not possibly do its work.

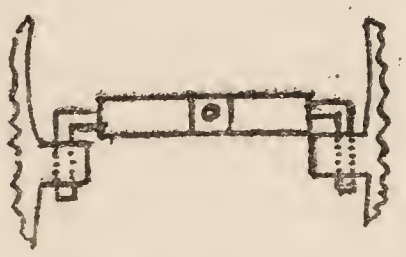
No fixed jack-screw could possibly push in the two directions shown in the diagram at the same time. Such a jack-screw would work under violent lateral strain and would tend to push one or both parts of the plate out of its place, or try to move the condyles out of their sockets; but if the screw was hinged, allowing movement in the horizontal plane, or loose at both or even at one end, that did not happen; it was free to move. The jack-screw should either be a perfectly loose thing with a rounded end fitted into a socket in the splint on each side—and perhaps for security tied with a piece of silk fishing line to a hole or stud in the splint, or, if great rigidity was required, it should be made with a hinge, as illustrated. That the pieces did really hinge on the condyles when they fell inwards was perfectly true, and, indeed, sometimes the condyle became forced outside its proper position without any pressure being applied artificially. If the hinge held too tightly the pin could be made considerably smaller than the tube.

Mr. Coysh said he had seen a good deal of the work that was going on in France and wished to express his gratitude to the staff of the Ecole Dentaire de Paris and the members of the dental staff of the American Ambulance, for the immense amount of time and trouble they spent in showing a party round and letting them see everything that could be seen. Generally the impression that was left upon his mind with regard to splints was that the French Institutions were in favour of a splint covering a considerable number of teeth and cemented on. He saw very few loose splints. Each of the three schools went in for a different type of splint. The Ecole Dentaire had a splint made of cast silver; the American Ambulance were in favour of a struck splint of German silver; while at another they favoured a cast splint made of Victoria metal. He had not been impressed with the latter, as it seemed to him the splint might have been made of silver. He was much struck by the neatness and simplicity of the capping they used. It was made of thin alloy metal struck over the teeth, usually struck in one piece, and the piece was generally roughly secured to fit over the teeth before it was struck, and the necessity for making it in two sections and joining it up did not exist. It was then stiffened by fitting a piece of wire the whole way round, and it was soldered solidly to the sides about half-way up the gum margin, and the margin was festooned so that it could be absolutely fitted in between the teeth to give an additional hold. The difficulty that struck him was that of removal. They had apparently found that difficulty in the Ecole Dentaire, and had constructed their splints with one end split and a screw uniting the two ends, and when they wished to remove it they could take the screw out and prise one end open. He was not particularly struck with the form of jack-screw used by the American Ambulance; it had holes in it and was turned by a small lever, and it seemed to him a jack-screw with a square head was far better, as the lever seemed to slip out of the holes when used, and to jar the patient considerably. The Ecole Dentaire seemed to prefer the steady gentle pressure of a coiled spring of Coffin spring to the intermittent force of the jack-screw. They made as many attachments on their splint as were likely to be used, so as to avoid the necessity for frequent removal and replacement.

Mr. W. Hern said he had used methods which their Society would claim as orthodontic in the treatment of several cases of fracture of the jaw, and which he found were good and efficient. One of the

cases he had shown at the Royal Society of Medicine was that in which he found the Angle tubes and arch exceedingly useful. The man had treble fracture of the mandible, having been struck by a bullet on the left side of the jaw ; the bullet knocked out the second molar, smashed the mandible, and, passing obliquely forward through the tongue, struck the first bicuspid on the opposite side, and broke the jaw there. The impact of the bullet on the side of the jaw had broken it in the mid-incisor region as well. The patient had a single wisdom tooth behind the point of entry of the bullet, and he fitted him up at once with a modified Hammond splint of silver wire, passing the wire round the wisdom tooth and bringing it forward around the buccal faces of the anterior teeth to the molars on the opposite side, and then between the molars—it was pulled tight to try and move the jaw back as far as possible from its forward displacement. He wired with cross-wiring, and left it as a temporary splint for ten days. Then, as a considerable displacement forward persisted, he fitted an Angle band with tubes on the wisdom tooth on the left side, and on the first molar on the right side. He then adapted the Angle arch and brought the forwardly displaced jaw back to the normal bite, screwing the Angle arch about once in three days. He thus obtained an absolutely perfect occlusion with no loss of teeth other than those broken by the bullet. That case was an illustration of the mistaken suggestion of Mr. Colyer that teeth should be taken out as a routine treatment on each side of the fracture. If teeth had been taken out on each side of each fracture in this case, he would have had to remove six very valuable teeth. The jack-screw was an extremely useful appliance for many purposes, but he had not found that a force so great as that of a jack-screw was required to separate the fragments of a jaw which had been broken, even when it had been neglected for a considerable time, and cicatricial tissues had bound the jaw down. He had used two methods. One was a series of widened Hammond splints, a wider splint being put in about once a week. If the front portion of the jaw had been shot away and the molars had been left, the molars would fall together, but by putting two fingers inside the arch, the jaw could be moved outwards quite easily, and the first Hammond splint should be made to the distance the jaw could thus be pulled out without giving the patient much pain ; at the end of a week the patient would be able to bear about another one-eighth inch, and so on through the series. Latterly he had adopted for another case quite a different method, a modification of a Coffin plate with a piece of nickel or silver wire bent like a " W," and placed vertically between the two sides of the plate. By grasping a suitable loop of the wire with a pair of pliers and straightening it out, the expansion of the two sides of the mandible can be effected to any extent without the removal of the plate from the mouth.

He quite agreed with Mr. Norman Bennett that it was an important point in the treatment of mandibular fracture not to immobilize the mandible if it could be avoided. If the splint was so placed that the fracture was fairly supported, it was a very great advantage to leave the mandible free at its joints, because it aided in the irrigation and cleansing of the mouth ; it also permitted a certain amount of mastica-



Jack-screw hinged at both ends.

Jack-screw with rounded ends to fit loosely into corresponding hollows in the splint.

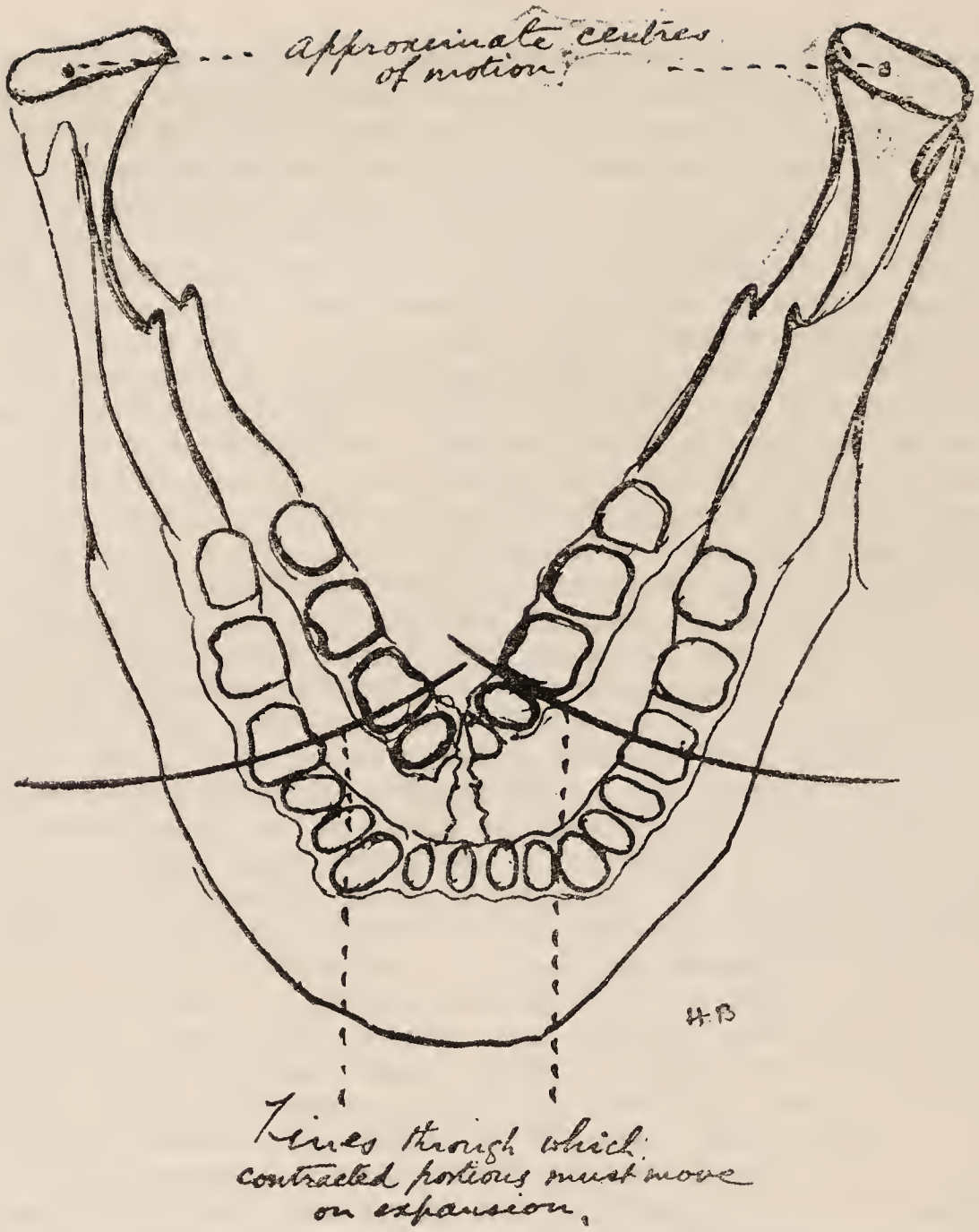


Diagram showing the need for the jack-screw being free to move at both ends or at least at one end where it is attached to or impinges against the splints.

tion on the part of the patient, and the use of the tooth-brush on the gums. With regard to the question of fixed *versus* movable prosthetic appliances, he preferred the latter; there were cases where a fixed bridge would be the best thing for the patient, but as the majority of hospital patients did not practise oral hygiene to a great extent, and the teeth that remained would be imperilled by a fixed apparatus, he generally chose a movable one.

(Mr. Hern exhibited slides showing foreign bodies in the jaw, the foreign body in one case being a metal coat button.)

Mr. F. W. MELLERSH wished to associate himself with Mr. Coysh's remarks in regard to the kindness of the French hospital authorities in Paris and the staff of the American Ambulance; nothing could have exceeded their kindness in granting every facility to visitors. He himself was rather inclined to think that where they could be used, fixed appliances would prove most satisfactory, provided the caps were carefully fitted.

Mr. HERN said his suggestion was that a movable appliance was the more cleanly.

Mr. A. E. ROWLETT: The forces used in orthodontics may be divided into three classes:—

1. Interdental.
2. Intermaxillary.
3. Cranio maxillary.

The two cases I propose to bring forward this evening are both of the first class.

Case 1.

This is a case of simple fracture of the mandible between the canine and first bicuspid on the left side; there is, as you may see from the models, but little deformity. (*See* Fig. A1.)

Cause of injury.—The fracture was caused by a kick from a horse, the patient being a master farrier.

Method of obtaining occlusion.—As there were firm teeth standing on either side of the fracture, and there was no loss of substance, there was no need to trouble about the occlusion. The injury was recent; I saw the patient three days after the injury and there was no loss of tissue.

Method of treatment.—Two Ash alloy splints were struck and cemented on to the two halves of the jaw. (*See* Fig. A2.)

On each splint just adjoining the fracture had been soldered two pins, so that the two fragments could be lashed together.

Ordinary Angle ligature wire was used, and the two ligatures were twisted diagonally, the free ends being cut short and tucked together. (*See* Fig. A3.) Complete immobility was obtained and a firm bony union resulted.

Dates of treatment.—Patient first seen three days after injury.
Splint fixed two days later.
Splint removed six weeks afterwards.

Case 2.

This is a case of compound fracture of the mandible, and was made more difficult by the swelling around the fracture and the absence of teeth in the posterior fragment. (*See* Fig. B1.)

The anterior or right fragment luckily contained a good number of sound teeth, the $\overline{8\,5\,4\,3\,2\,1}$ | $\overline{1\,2\,3\,4}$, in the posterior or left fragment only of wisdom tooth was left standing, and it was elevated and slightly inverted.

Cause of injury.—The fracture was caused by a blow from the butt end of a German rifle during an ambushed attack upon some transport waggons. The patient was a sergeant in the A.S.C.

Method of obtaining occlusion.—The patient fortunately wore plates, and although they were broken, I was able to sufficiently reconstruct the bite to indicate the occlusion.

Method of treatment.—I first made a splint in one piece. A piece of Victoria metal was struck over the front teeth and joined by two thick German silver wires to a band fitted round the left lower wisdom.

I reduced the fracture under ether, and sprung on the splint, hoping to keep the jaw in position for twenty-four hours, and then cement it into position. This proved unsuccessful, as although I had made all the parts of the splints heavy, they gave and buckled up.

I now made a two-part splint.

The anterior portion consisted of Victoria metal, No. 4 gauge, strengthened with silver solder and having an extension of German silver into which has been soldered the nut of a Badcock's screw. (*See* Fig. B2.)

The posterior portion consisted of a German silver band fitted to the $\lfloor\overline{8}$ also with an extension of German silver plate under which has been vulcanised a saddle fitting upon the gum.

When the two halves of the splint had been cemented into position, they were left for twenty-four hours, then the screw was put through the bolt, and two full turns given each day; this slow method of reduction proved very painful, and after two days I reduced the fragment under chloroform and screwed down the bolt.

Very little pain was experienced, and the next day I fixed the retention piece.

This was a piece of metal shaped almost like the letter "Z," but with angles between the parts, right angles instead of acute. To allow of fixing this, four pieces of wire from an orthodontic alignment arch had been soldered to the splint, two to each portion. (*See* Fig. B3.)

Holes were drilled in the retention piece, and the whole thing made rigid with nuts. Since that time there has been no discomfort at all.

An upper plate was inserted and the patient can eat everything but meat.

Dates of treatment.—Patient first seen two weeks after injury.

First splint tried in two weeks later.

Second splint fixed four days after this.

Splint not yet removed, but on loosening five weeks after fixing, there is apparently bony union and very little give in the jaw.

A swedged splint is easier to make and fix, and requires less of the operator's time than orthodontic bands.

In my hands, a splint made in two or three portions, and the various portions secured to each other with bolts and nuts, is preferable to a splint made in one piece ; as one end may become loose and considerable difficulty may be experienced in removing the firm portion of the splint. A tooth-brush and H_2O_2 properly applied by the patient is the best antiseptic.

Always, in designing the splint, make provision for any additions that may be necessary, so that when once the splint is fixed, it need not be removed, but may be used as a retention.

Mr. COYSH said the wires which were soldered along the inner and outer surfaces of the struck splint should be carried round the ends or have cross-pieces going between the teeth in order to get stiffness, otherwise they would obviously collapse.

Mr. GEORGE NORTHCROFT asked Mr. Lewin Payne how he had taken the beautiful model for a restoration he had shown at the Royal Society of Medicine. With regard to the use of intermaxillary traction, he would like to know whether it was preferable to the double cap splint as used by Mr. Colyer, and whether the utilisation of a spur and plane would be sufficiently strong to prevent cicatricial contraction, or whether the spur and plane on the denture must be put in after all contraction had taken place. He had heard no one speak of the use of studs soldered on the buccal surface of a cap splint, which give extra security by wiring to the necks of the teeth. A removable metal cap splint could be made easily removable in that way for the first few days.

Mr. Northcroft then exhibited a slide of the case of a man whose jaw was injured by a bullet. The bullet entered just above the left angle of the mandible, fracturing the ascending ramus, in front of second molar, the region of the left canine, and carried away the right side between the ascending ramus and second pre-molar. He thought it should be established as a principle that all such cases should have the co-operation of dentist and surgeon at the same time. The first wisdom tooth was lying buried in the jaw, and when he removed the fragments of the second molar the wisdom started erupting into the fracture and was removed. When the various fractures on left side of the mandible were united, the jaw swung across to the right, on account of the contraction where the large portion had been shot away. He treated this condition by intermaxillary traction. The problem was, how many ligatures were required to counteract the force of the contracting tissue ? This patient had two rubber bands which held the jaw in perfect occlusion, and he could chew fairly well. It was very important that the intermaxillary traction in such cases should be horizontal when the jaw was at rest. If the ligature was at an angle when the jaw was at rest, there was too much upward pull on the lower jaw.

He would also like to refer to the mouth-frame for the display of oral conditions, which he had found more simple for holding back the lips than the fingers or cheek-retractors.

Mr. Lewin Payne said the case Mr. Northcroft referred to was that of a man in whom a gunshot wound had carried away the anterior portion of the maxilla, together with the whole of the upper lip and the lower portion of the nose, and had fractured the mandible on the left side. The impression of the mouth was taken with plaster of Paris, and while the impression was still in place he took a model of that portion of the face and nose required for the purposes of restoration, by means of modelling composition moulded with the fingers. It had to be taken in two sections. The modelling composition was removed first, and the tray with the impression of the mouth subsequently. The three portions were fixed together, and the model was then made by pouring in plaster in the ordinary way. In regard to the general question under discussion, it had been the study of orthodontics which had taught dental surgeons to understand the importance of the occlusion of the teeth, and he was afraid many did not really recognise what normal occlusion was until they began to study orthodontics. Orthodontics played a very important part in the restoration of jaw deformities. In the treatment of cases it was necessary to distinguish between what was understood as normal occlusion and the occlusion normal to the patient. He believed Mr. Norman Bennett had a case in which it was only on piecing the fragments of the model together that he found the occlusion of the patient was distinctly abnormal prior to the injury. One good example of this was shown by the American Ambulance at a recent exhibition. The wounded man had an abnormality of Class III type which, in the process of treatment of the injury, was corrected. With regard to the classification of appliances, they might be well grouped under the headings of 'Interfragmental Appliances," "Intermaxillary Appliances," and "Cranio-Maxillary Appliances," and all of these in essence followed out the lines of orthodontic treatment.

Mr. J. H. Badcock said he had seen one cranial maxillary appliance which struck him as being simple and efficient. Instead of the ordinary chin and head cap connected with elastic bands, a simple band of india-rubber about 2 in. wide was used, which simply went round the man's chin and was pinned by means of a safety-pin on the top of his head.

Mr. Norman Bennett, in replying on the discussion, said perhaps he had drawn too narrow a line in considering the question, but he wanted to limit the subject. He quite agreed with the classification of appliances put forward by Mr. Payne. The case referred to by Mr. Payne was a very bad one, and in placing the fragment in occlusion with the upper, in order to make the splint, he made a mistake and placed the teeth in normal occlusion, and could not make out why the splint seemed so big. Then he found that the mandible must have been in post-normal occlusion, and set the model up differently, and it was all right in the end ; the patient, whom he had seen that day, looked quite normal. With regard to Mr. Northcroft's case, where there was a fracture and the two parts showed the most extreme reluctance to come into normal occlusion without any splint at all, it seemed to him difficult, with the patient underan anæsthetic, to open the mouth, dry the teeth and keep them dry,put the parts into a normal position, hold them there, mix cement and put the splint on. His experience was not enough to enable him to give any definite opinion with regard to the point of the best method of dealing with lateral deviation, especially in fractures of the angle, but he thought the spur and plane was not suitable except more or less as a retention apparatus. If there was any strong tendency on the part of the jaw to go the wrong way, he did not think the spur and plane was sufficient to keep it going the right way. Where one was dealing with the jaw as a whole, and not in two fragments, he firmly believed in intermaxillary force, and thought the direction of the elastics should be as nearly as possible horizontal when the parts were in occlusion.

He used pieces of thick sheet rubber, and thought it was most convenient and most pleasant for the patient. He had used a sort of removable Gunning, but believed it was only suitable when the tendency to deviation was very slight and where the splint, together with the bandage, was sufficient to bring the jaw in position and hold it firm. With regard to Mr. Baldwin's point on the use of the Badcock screw, he had been stupid enough to use a Badcock screw on a splint fixed to the jaw on both sides before realising that it was certain to come off as soon as it began to do any good ; it came off, not only for the reason Mr. Baldwin explained clearly, but because in most cases there was depression of the fragment on one side or the other, and therefore as the screw opened, it tended to go up at one end and down at the other. On the other hand, he did not think it was necessary always to use the screw in the direction which Mr. Baldwin showed.

A vote of thanks was accorded to Mr. Maxwell Stephens for his Casual Communication, and also to Mr. Norman Bennett for opening the discussion, and to those who had taken part in the discussion.

ORDINARY MEETING.

The meeting was held in the Rooms of the Medical Society of London on October 8th, 1919, Mr. Spiller, President, in the chair.

Mr. Bertram B. Samuel read his paper:

Suggestions for the Formation of a London Orthodontic Centre.

The writer, in his association over a period of ten years with various London Children's Hospitals and L.C.C Dental Treatment Centres, has had his attention directed to the following points:

(*a*) The difficulty of obtaining the necessary orthodontic treatment for children other than those of the comparatively wealthy classes.

The existent Dental Hospitals have more of this type of work than they are able to undertake. It is realised that a great amount of treatment is also done by private practitioners without charge or for fees inadequate to the services given, but the majority of dental deformities go uncorrected.

(*b*) The want of appreciation of the fundamental principles of orthodontic science shown by the average dental practitioner, and his consequent lack of interest in what should be one of the most absorbingly interesting branches of dentistry.

It is suggested that in this matter the Capital of the British Empire should not lag behind Continental and American cities, and that a School should exist at which all the leading London Orthodontists would be associated, where undergraduate and post-graduate classes would be given, and, shortly, where the vast amount of clinical material at our command here in London could usefully be employed.

The writer feels certain that there would be no lack of senior students and practitioners willing to pay a fee for the privilege of attending Courses at such an Institution, and the plethora of cases where treatment is desirable and desired is manifest to any who have had the opportunity of seeing large numbers of children of the artisan and industrial classes.

Provided that such a scheme had leading professional support, following on the appointment of a small Committee (by, say, this Society), the subjoined steps could be taken to give it being.

Consideration of various methods to obtain financial support, such as—

(1) Appeal to the Public through the Press.
(2) Private appeal to wealthy individuals.
(3) Address to Ministry of Health.
(4) Request to L.C.C. asking for capitation grant for L.C.C. scholars attending.

There are, of course, many other points that it is needless to elaborate at this stage, but granted that his premises are accepted by the Profession, the writer is of opinion that none of the difficulties are insuperable, and that such an Institution would be of immense service to the Profession and directly and indirectly to the Public.

The PRESIDENT, in opening the discussion, said a London Orthodontic Centre would be more useful to the post-graduate than to the undergraduate, as the latter received teaching at his own school. Another point was whether many of the thousands of children needing treatment would go to a central place rather than to places in their own localities.

Mr. NORTHCROFT agreed with the President that a course of study could only be adapted for post-graduates, as undergraduates had their time already very fully occupied at the hospitals, at which they were taught the rudiments of orthodontics. That teaching, perhaps, from the Society's point of view, might be inadequate, but he thought it would have to do for the undergraduate. It seemed to him that the Society itself in a large measure filled the want of a post-graduate centre, but that possibly there might be a course undertaken for elaborating the technical side of the work within the Society rather than to go farther afield, at any rate at the present time. As to the vast amount of material there was, he was free to confess that the time occupied over those cases which were treated in any elaborate way at all for the working classes made it difficult, simply because of the children having to be brought by parents who could really ill afford even bus fares. Therefore he thought that having one centre at which the material could be used would be impracticable; he did not think it would work at all if children had to come long distances, It might be possible to work orthodontic centres connected with the London County Council clinics if the London County Council authorities could be stimulated to take an interest in the subject, but then is became a question whether the officers connected with the London County Council clinics would be willing to undertake such work. While he was very heartily in sympathy with the proposition, he did not think the time was yet ripe when it came within the range of practical politics.

Sir HARRY BALDWIN thought the point to aim at was to improve the orthodontic teaching at the dental hospitals and to get a large amount of work done there. If they did that for the undergraduates they might be induced to do it also for the post-graduates. It seemed to him that it would be multiplying bodies too much to have, in addition to the dental hospitals and the Society, another body. He thought if the Society stuck to its work well and made its results known better the effect would be sure to be felt very soon in the dental hospitals, and their orthodontic departments would get improved. He thought it was in that direction that any further extension such as the writer of the paper had suggested should be looked for.

Mr. PITTS remarked that, so far as the paper was a plea for the wider teaching of orthodontics, most of the members of the dental profession would be in hearty agreement with Mr. Samuel. Speaking from his own experience in teaching students, he thought the dental student did not learn sufficient about orthodontics, and learnt still less about what was even more important, namely, the treatment generally of children's teeth in conditions apart from irregularities. The student was rather apt to think of children as being merely children who only required treatment for irregularities of teeth, and a great deal more than that should be learnt by the student. He (Mr. Pitts) did, however, feel that the best place for the under-

graduate was certainly the dental hospital, but his own impression was that at the present time the teaching on that subject was not so good as it should be. He had seen it just recently announced that at Guy's Hospital there was going to be a special lecture in the subject, and presumably there would be a wide reorganisation of the department, which, he thought, would go far to meet the need. No doubt other dental schools would follow the same lead, and that in future the dental student would be very much better trained in that respect. With all the County Council openings that were arising, it was important that the student should have a very wide knowledge of all conditions met with in children, and also should know how to treat children to the best advantage. With regard to a centre outside, if some wealthy person would endow something similar to the Forsyth Institute in Boston he would confer a very great benefit on the children of London. Such a centre would become the focus to which all interested in the treatment of children's conditions would be drawn and also for post-graduate teaching; but it seemed to him a grave question whether at the present time, with the future of dentistry so very undecided and with all manner of legislation in the air, any centre outside the hospitals (which would mean a very large capital sum) was advisable, and whether dentistry would not be better served by strengthening the position of the existing hospitals both so far as their teaching and their financial position were concerned.

Mr. HIGHTON wondered whether a centre such as proposed by Mr. Samuel could probably do more in the way of propaganda work than a body like the Society or the hospitals. He thought, with the present knowledge of orthodontics, there was a great need for propaganda work. There were certain cardinal principles of which dental practitioners realised the importance, but of which the general public knew very little; in fact, he knew the majority of nurses, and even some doctors, still advised the use of the "dummy." The average medical practitioner probably knew very little about the welfare and the feeding of children, and it seemed to him that an institution of the kind suggested in the paper would do a great deal towards enlightening the public in that way—much more than the hospitals.

Mr. HAROLD CHAPMAN said most of the speakers had already referred to the chief points connected with the subject, namely, the difficulty of treating the children, as mentioned by Mr. Northcroft, and the training of men to treat the children. He was entirely in sympathy with Mr. Samuel's idea, and he felt it was extremely unfortunate that criticism of it had to be of a destructive rather than of a constructive nature. One knew from one's own hospital experience how hard it was to get anything done, and to his mind the problem was as to how much should be attempted in these cases, and he would like to arrive at a conclusion on that point before going further. He could not see that a high standard could be aimed at as long as the curriculum remained as it is, overburdened with things which were so very material—not that he did not consider orthodontics material—but it was becoming such a wide subject and so complicated in its treatment that it would be very difficult to train students to a higher level without detriment to their training in other branches of work (unless the course was lengthened). Therefore it seemed to him an almost insuperable problem, unless orthodontics was made compulsory in the curriculum to a far greater extent than at present. Mr. Pitts had referred to the Forsyth Institute in America, in which orthodontics had been undertaken, but at the same time it should be remembered that in Pennsylvania (he could not speak for the other schools) the treatment of patients for orthodontic work was not compulsory at all. That being so, it seemed to him to point out very strongly the difficulties there were in this matter. On the other hand, he was quite sure that there was a widespread desire that there should be post-graduate teaching in orthodontics. He had been approached himself

several times in the matter. He remembered some two years ago some Birmingham practitioners suggesting to him the possibility of doing something in that way, but the war being in full swing, the matter had to drop. It seemed to him that whatever might be decided must be practical and capable of being carried out, and so it became a question of how much should be undertaken rather than to attempt to get perfect arches for all the children.

Mr. B. Bull thought the great trouble in all orthodontic cases regarding teaching was the way the patient and operator had to be interwoven. At Guy's Hospital there had now been started a three months' compulsory children's dressership, to be held only during the student's fourth year. Until a student reached his fourth year, that was the second year of his clinical course, he was not in a position to undertake orthodontic work ; he did not know enough about the other parts of dentistry. When he did come to his fourth year, then he knew sufficiently the elementary part of dentistry to start to undertake those cases. He saw all varieties of cases which he treated the whole time he was holding the dressership, intermingled with other work on children up to twelve years of age (orthodontic cases, of course, irrespective of age). So that at the start of his three months he had not touched an orthodontic case at all ; at the end of that three months he had finished with his orthodontic cases. He (Mr Bull) thought that was very much better than spreading them over two years or perhaps a year and a half, as used to be the case, because the student had a chance of seeing cases at all periods of treatment, whereas formerly he saw one for about six months, attempted to do something, and then for the following eighteen months tried to hide the case as much as possible from anyone in authority seeing it, until perhaps two or three years later a very stringent letter came up from the Superintendent asking why the child had not been seen to, by which time probably it was too late to go on with any treatment. So he (Mr. Bull) could see in Mr. Samuel's idea a very great difficulty present. Unless the operator and patient were brought into personal contact week after week for a good many months the thing was going to fail. Regarding what Mr. Highton had said about propaganda, Guy's had far more cases than could be dealt with. Only that morning he had seen a patient who had been sent on from the University College Hospital Dental Department, because they were too busy to undertake it. He thought Mr. Samuel's suggestion, although a very worthy one, would prove unsuccessful.

Mr. Harold Chapman then read the following communication from Mr. Mellersh :

"Mr. Samuel has kindly given me an opportunity of discussing with him the subject of his communication to the Society. To my mind, from the Empire point of view the matter of improved dental education and post-graduate teaching demands the closest attention, not only in regard to orthodontics but to operative and prosthetic work as well. I hope something tangible will result from Mr. Samuel's suggestions, with which I am in entire agreement."

Mr. Stephens remarked that one very important point in regard to Mr. Samuel's idea was that of man-power—those who knew, and who were prepared to carry out the work. In order to secure sufficient man-power—by which he meant people who were accomplished to do the work—the profession would have to be enlarged. That would be the first thing. Then the knowledge of those who were interested in the subject in the profession would have to be consolidated. That could be done best, it appeared to him, from the Society which already existed. Then one had to get a band of enthusiasts and then the money. Those were the steps which it appeared to him were necessary. In regard to propaganda, he took it it should be carried on amongst the profession before the public, in order that practitioners might

make themselves competent to carry on the work and in order to get at the best points of the scheme.

Mr. HIGHTON pointed out that his suggestion with regard to propaganda was not so much pushing the idea of orthodontics forward as pushing the idea of preventive treatment of dental irregularities. If people could be given some idea of the essential and cardinal principles which they might adopt to avoid irregularities, either by the publication of pamphlets or by the setting up of a Centre, it would be of great value.

Mr. SAMUEL, in reply, said he feared most of his ideas might have appeared to the members as the ravings of an idealist ; but as a dentist to a London County Council centre, he came in daily contact with parents of children who needed orthodontic treatment who would be delighted if he could say to them, " There is a centre in Oxford Street where you can go for treatment. They will tell you how long the treatment will last. It will probably be for a period of a year or eighteen months. You will have to go once in three weeks, and every time you go it will cost you half a crown." They would be only too willing to go if they could be assured they would get the best treatment there. That was one side of the picture. From his experience he could say there would be no lack of patients. The other side of the picture was that in London, the capital of the British Empire, there really was need for a post-graduate school. Every colonial and provincial dentist at one time or another came to London, and to the mind of an outsider in such matters like himself it appeared that London was not holding the position it should. If things were properly organised, every graduate at a provincial school would feel the need of a course at the London Orthodontic Centre before he threw himself on the world. The existing hospitals were lamentably overcrowded. Mr. Bull and Mr. Pitts had said that the teaching had changed very much. He (Mr. Samuel) remembered spending most of his time studying the personal idiosyncrasies of the examiners—those who regarded the extraction of the six-year-old molars as crass mutilation and those who thought otherwise. Speaking as an outsider, he thought most practitioners were very ignorant on a subject that they really should know a lot about, and it appeared to him that, granting the two premises that there were patients clamouring to be attended to and willing to pay small fees, and that there were numbers of men willing to sit under those who were the leaders in orthodontics, something might and should be arranged.

A paper was then read by Mr. SHELDON FRIEL, B.A., M.Dent.Sc., on

Lingual Arches for the Correction of Malocclusion of the Teeth.

During the last few years not many new developments in Orthodontia have appeared in the English journals. The suspension of the Meetings of the British Society for the Study of Orthodontics withdrew the necessary discussion on the difficulties that one meets with daily.

In America certain types of appliances, such appliances as move teeth bodily as Angle's Pin and Tube[1], Angle's Ribbon Arch[2] and Robinson's Loop and Block appliances[3] have been developed, and one might say over-developed. It appears to me that these appliances are exceedingly fine from the mechanical point of view. That if the teeth, etc., were not alive, that they would be almost ideal in their construction. Now unfortunately the teeth and their sub-lying structures are very much alive, and are dependent for their growth and development on the perfect balancing of the various forces of occlusion, and if these orthodontic appliances

interfere with any of these forces, they are quite likely to do more harm than good.

The ideal appliance will be that which not only corrects the irregularity of the teeth, but also does not interfere with nature's methods for the development and maintenance of normal occlusion. It will be simple, easily applied, easily kept clean, inconspicuous, and its force will be so gentle, yet constant, that no pain will be caused.

Such appliances as I have named hold the teeth too rigidly together, so that the forces of mastication must be transmitted in an unnatural manner from one fixed tooth to another fixed tooth. This must lead to faulty development of bone around these teeth, and one does find in practice that these teeth that are held rigidly become very loose and often remain loose.

The other great disadvantage that I found in these appliances was that they contained so many angles and crevices, that it was impossible to keep them clean, such places, for instance, as the edges of the pins and tubes in Angle's Pin and Tube appliance, and between the ratchet and bar in the Ribbon arch.

In a few of the cases that I had under treatment with these appliances I got marked recession of the labial gum margin of the lower incisors, and I believe it was due to the constant irritation from the products of fermentation of débris or growth of bacteria around these pins and tubes, etc. (Fig. 1).

For these reasons in 1916 I started to experiment with appliances acting on the lingual surface that would not interfere with the forces of occlusion, and that would be of such a nature, and in such a position, that the tongue and saliva could keep them physiologically clean.

The action of the tongue against the lingual arch, the continual bathing of the arch with saliva and the alteration of its relative position to the gum margin following the tightening of the nuts, etc., all tend to develop healthy tissues.

Early in 1917 I had my first two lingual arches in use. Apparently similar appliances were in use in U.S.A. some considerable time before this, and papers on lingual arches appeared in the Journals by Mershon[4] of Philadelphia, and Dewey[5 & 6] and Lourie, of Chicago.

The main differences between my appliance and the appliance used by Mershon[4 & 7] are in the application of the force to move the teeth and in the amount of freedom to the anchor teeth. In my appliance the force obtained to increase the size of the wire arch is by means of a nut and screw on the arch working against a horizontal tube on the molar bands, instead of by the opening of loops in the wire arch which is anchored to the molar teeth by means of half-round vertical tubes and a modified Young-Angle lock.

The amount of force can be much more accurately gauged by a nut and screw than by the opening of loops, the attachment to the molars is more self-cleansing than the Young-Angle lock, and the anchor teeth are less rigidly held in a horizontal round tube, which allows them to have individual movement during mastication, than in a vertical half-round tube, where the stress of mastication on one side must be transmitted to the anchor tooth on the other side.

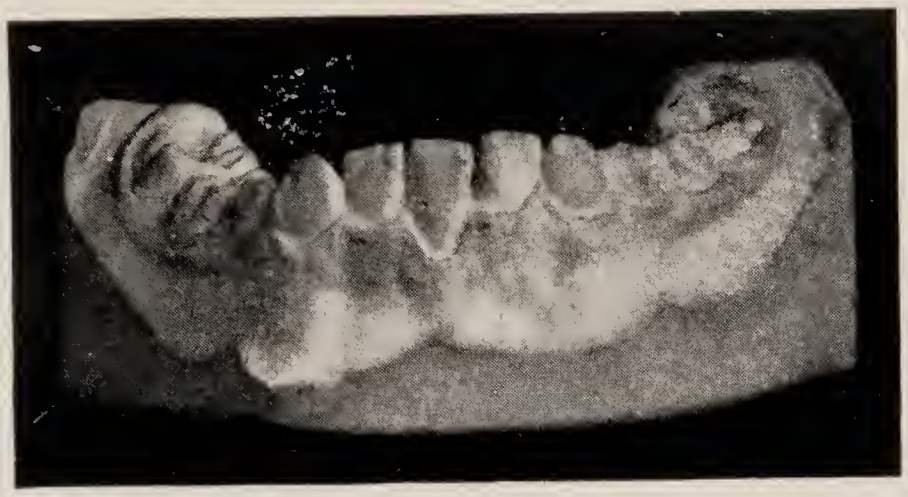


FIG. 1.

FIG. 8A.

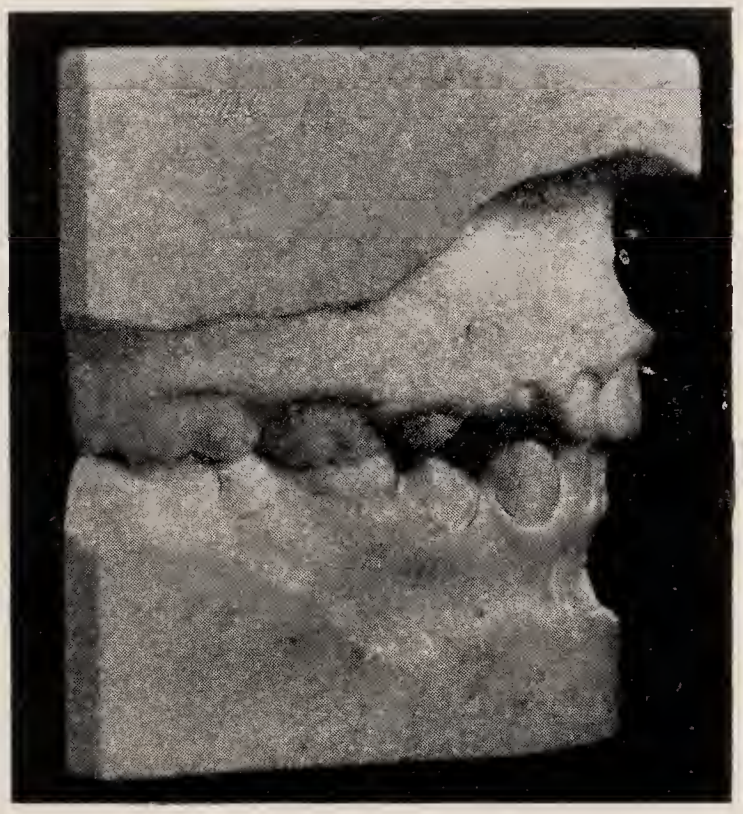


FIG. 8B.

FIG. 9A.

FIG. 9B.

FIG. 10A.

FIG. 10B.

FIG. 11A.

FIG. 11B.

FIG. 12A.

FIG. 12B.

The appliance consists of a Gold Platinum Arch, .034″ diameter, with screw ends. This arch fits into horizontal round tubes soldered to Molar Bands. The walls of the tubes are thick.

Outside diameter	... ...	.072″
Inside diameter	... ...	.037″
Length of tube	... from .5″ to	.625″

The mesial end of the tube is filed in the form of a ratchet, and the distal end of the nut on the arch is also filed so as to engage this ratchet, the object being to prevent the loosening of the nut either by the action of the tongue or during mastication (Fig. 2). The nut can only be turned in one direction unless the arch is withdrawn from the tube sufficiently for the nut to escape the teeth of the ratchet.

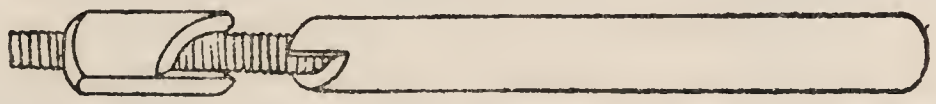


Fig. 2.

The molar bands are plain bands with an overlap joint. These bands can be made by the direct or the indirect method, as described by Mershon,[4] Dewey[8 & 9], and Hawley.[10]

The method that I have adopted is similar to that carried out by Dr. Le Roy Johnson, of Springfield, Mass. It is as follows: The greatest diameter of the tooth to be banded is measured by squeezing a thin annealed copper strip around it. The band material is cut the exact length of this measure and an overlap joint made. The collar is now made roughly the shape of the tooth, the joint being situated at the disto-buccal angle in the lower jaw, and on the lingual or distal surface in the upper jaw. The collar is now forced into its place by biting, a thin flat stick being held between the coronal edge of the band and the opposing teeth. By gradually working up the collar in this manner, and occasionally taking it off to contour it with a modified Peeso's crown contouring pliers at the parts where it is bearing too tightly, a very tight-fitting collar can be made.

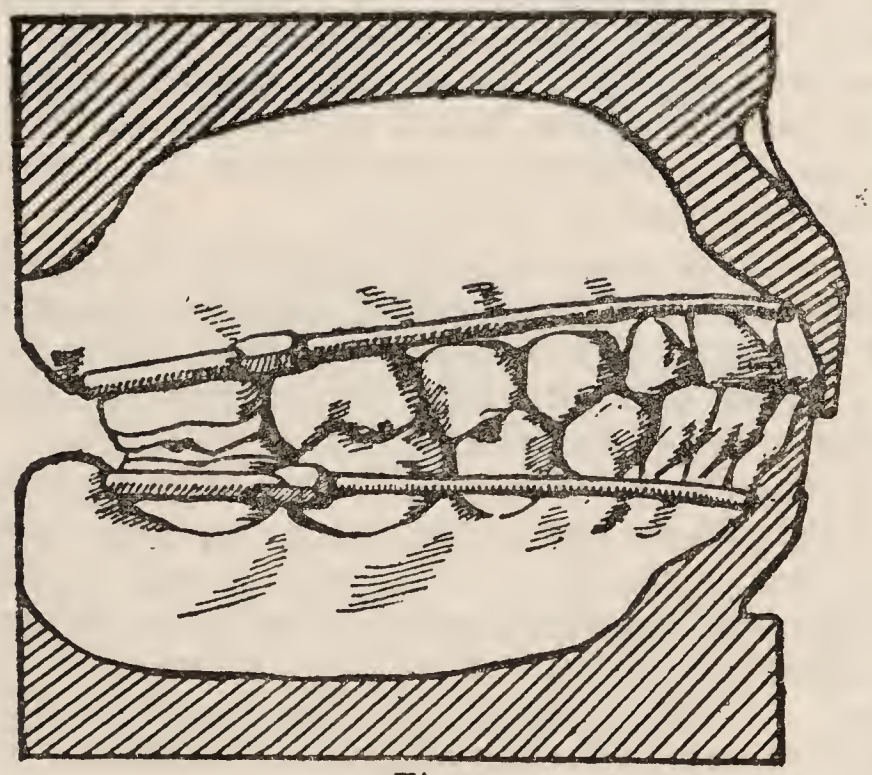


Fig. 3.

The coronal edge may be burnished over the crown or in other cases little slits cut, and the edges of the slits overlapped and soldered. It is advisable to festoon the mesial and distal surfaces at the gingival margin.

The material that I have used is a non-corrosive metal, a form of Aluminium Bronze, which I have also used for the tubes and nuts.

The positions of the tubes both on the horizontal and vertical plane require very careful consideration. In the horizontal plane in the upper jaw, the tubes should be soldered close to the cervical margin, and in the lower jaw, nearer the coronal margin of the band (Fig. 3.). In these positions the wire arch will lie below the cingulum of the incisors. In the vertical plane the position will depend on the movement of teeth that is required. To move the incisors mesially only the tubes should be parallel. To move the molars, and pre-molars buccally and the incisors mesially, the tubes should be placed with the mesial ends converging.

The bending of the arch can be done either to the mouth or to a model. It is at first bent as accurately as possible without placing it in the tubes. One band may now be removed and one end of the arch placed in its tube, the band replaced to see that the other end lies correctly over and parallel to its tube. Both bands should then be removed, the ends of the arch placed in their respective tubes, and the whole appliance tried in position again. If this is now found to be correct the bands are removed and the whole appliance is cemented in at the one time.

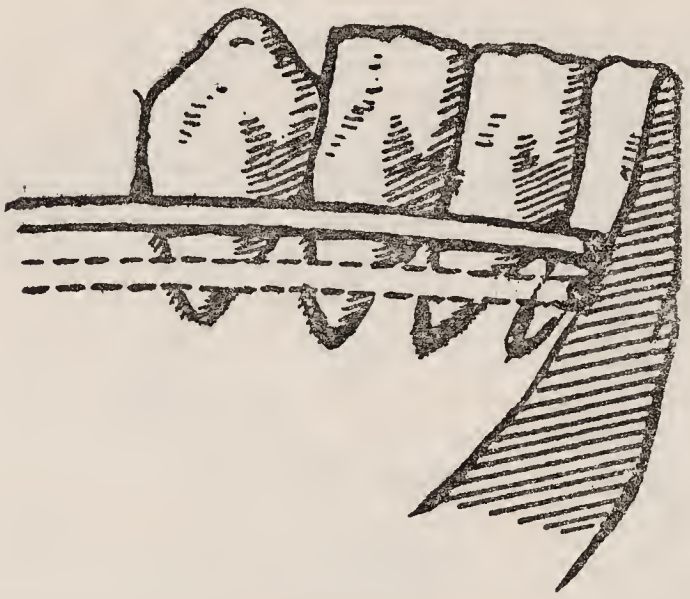


Fig. 4.

During the treatment it may be necessary only to tighten the nuts (Fig. 4), so that the arch rises up on the inclined plane of the cingulum and is there under tension until the teeth move forward and the arch resumes its place below the cingulum ; or in other cases to remove the arch and alter its shape for the buccal movement of molars and pre-molars, or for the alteration or additions of springs or fingers for individual movements of teeth.

When the arch is removed for alteration in its shape, careful measurements should be taken of the distance between the ends of the legs of the arch, if the molar anchorage does not require to be moved. I met with very little difficulty in the removal of the arch from the tubes, and replacing it in them again.

I found it desirable in certain cases to have some form of anterior attachment to prevent the arch being displaced from its tubes. The construction of the plain bands with a pull-to joint seemed to have the same disadvantage as the pin and tube had in Angle's Pin and Tube appliance, which is that the sides of the joint cannot be kept clean. There is also the disadvantage, if the joint is made in the lingual surface, that any spur or attachment would have to be soldered next the joint.

I devised a method of making an overlap joint. It has proved to be clean, strong, and mechanically a better band.

A strip of irridio-platinum band material about $1\frac{3}{4}''$ long is taken and one end is soldered to within $\frac{1}{8}''$ of the other end, thus leaving a free end of $\frac{1}{8}''$ inside the circle (Fig. 5*a*). The ring is now placed on the tooth to be banded as in Fig. 5*b*; and the band squeezed as if for a pull-to joint, care being taken that the

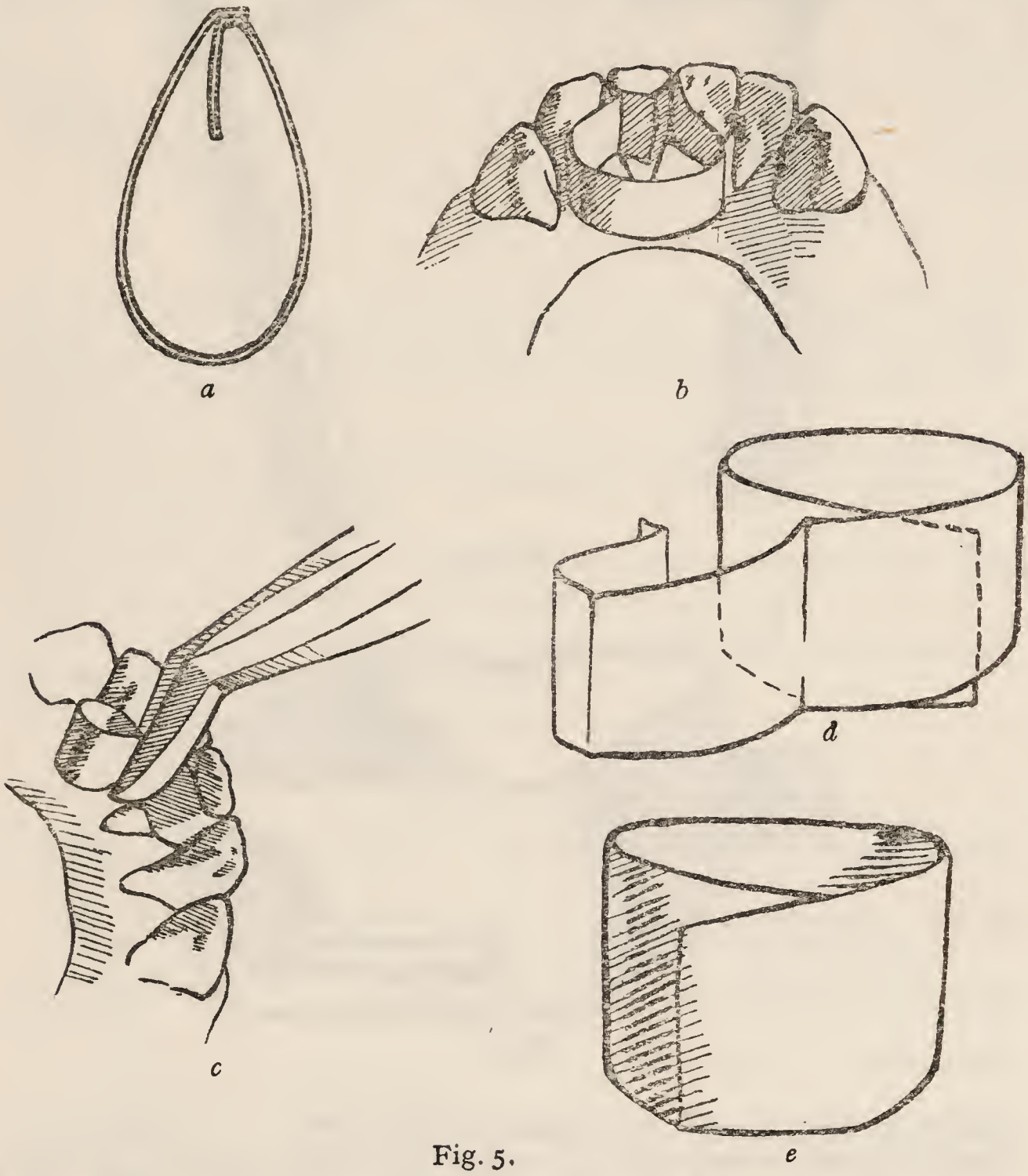


Fig. 5.

blade of the pliers next the soldered end is kept steady, and the other blade brought towards it (Fig. 5*c*); the free overlap is now soldered to the part lying over it and the original soldering undone (Fig. 5*d*); the surplus is then cut off, leaving a band made with an overlap joint (Fig. 5*e*); any attachment can be soldered on top of the joint of a band made by this method.

It is possible also to make a series of bands occupying the same relative position on each tooth.

The attachment soldered to these bands to prevent the displacement of the arch should give sufficient play to allow the banded tooth free movement during mastication.

I found that the constant heating of Angle's soldering tweezers holding the joints of the irridio-platinum band material together

soon burnt the ends away. Pieces of the standard of an upright incandescent gas mantle were substituted for the metal ends. They take up little heat, and do not burn away (Fig. 6). The attachment for intermaxillary elastics from the plain bands on

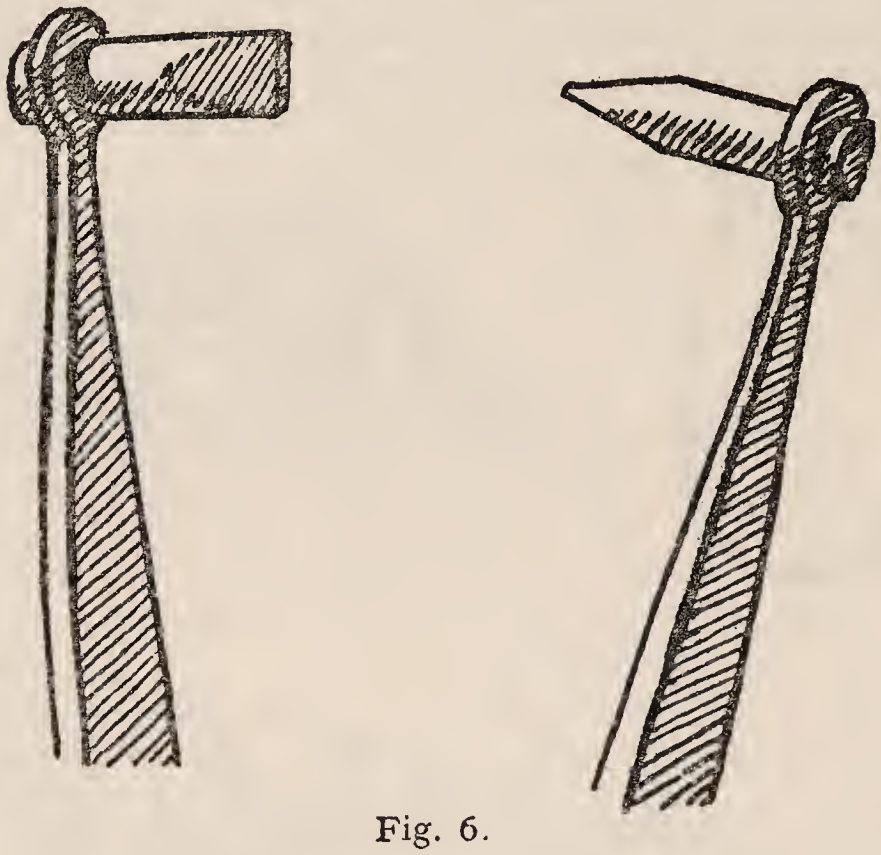


Fig. 6.

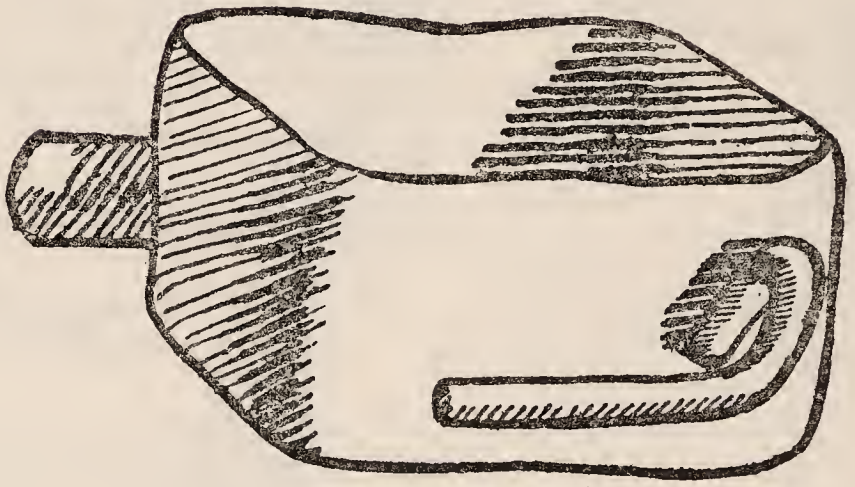


Fig. 7.

molars to buccal arch on opposite jaw should be soldered at or near the mesio-buccal angle so as not to tilt the molars. The hook should be bent at an angle (Fig. 7), which prevents the displacement of the elastic during mastication.

The combination of the lingual and buccal arches in the upper jaw in the treatment of Class II., Div. II. (Angle), or for the buccal expansion of the upper jaw in Class II., Div. I. (Angle), was found to be a great advance on other methods of expansion.

The opening of spaces for unerupted teeth in the upper jaw has shown satisfactory results. In the lower jaw I have used no other appliances except in Class III. (Angle) type of cases.

The number of visits of the patient were greatly reduced. Less had to be done at each visit, and the patients suffered no discomfort. The results that I secured were better in every way than any I had obtained with other appliances.

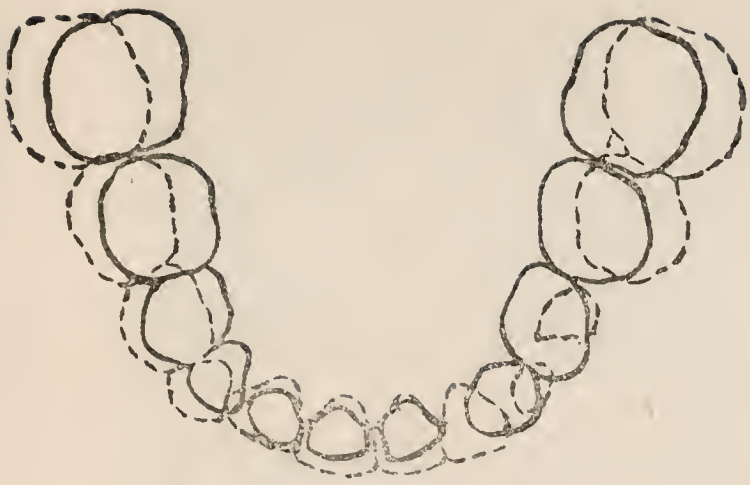


Fig. 9c.

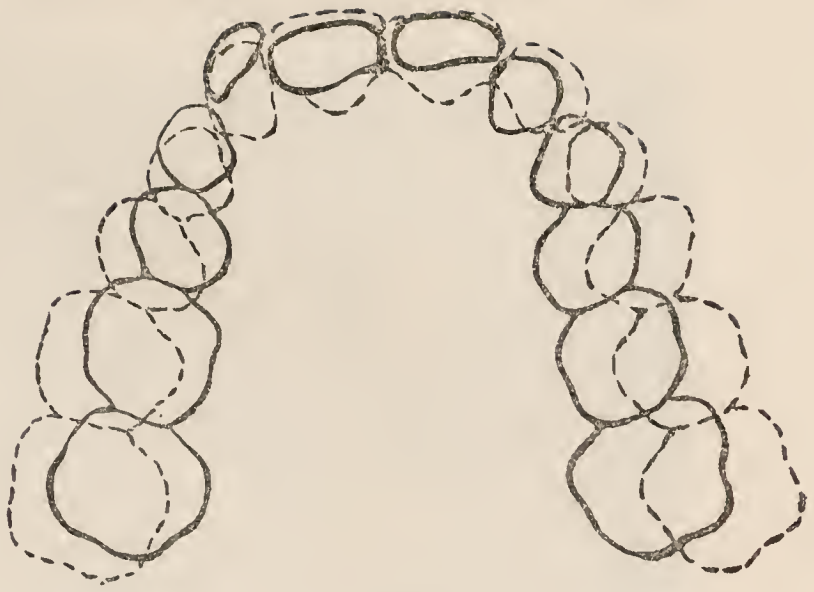


Fig. 10c.

FIG. 8, A and B.—Case of Class II., Div. I. (Angle) treated with lower lingual arch, upper buccal arch, and intermaxillary elastic traction from hooks on lower molar bands to hooks on upper arch opposite canine.

FIG. 9, A, B, and C.—Expansion of lower dental arch with lingual arch. (*c*) Drawing of (*b*) superimposed on (*a*). Drawn with Winkel's drawing board.

FIG. 10, A, B, and C.—Expansion of upper dental arch with lingual arch. Drawings of (*b*) superimposed on (*a*).

FIG. 11, A and B.—Opening of space for right lateral incisor, and the forward movement of lateral.

FIG. 12.—Opening of space for left canine.

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Discussion on Mr. Friel's Paper.

Mr. Northcroft congratulated the author on his paper and paid a tribute to his enthusiasm in having come all the way from Ireland to deliver it—a fact for which the Society was deeply grateful. He would like to ask Mr. Friel how he removed the inner arch from the tube. Mr. Friel had said it was easy, but it struck him (Mr. Northcroft) that it would not necessarily be easy—in his own hands, at any rate. He would also like to emphasise the most ingenious and excellent scheme of using old mantle uprights for the soldering pliers. Another thing which he liked very much was the little kink in the hook for the inter-maxillary traction elastics, which was another good technical point. He would like Mr. Friel to elaborate a little more the ratchet nut and how it actually worked in practice.

Mr. Badcock added his thanks to those of Mr. Northcroft's to Mr. Friel for his great self-sacrifice in coming from Ireland to give his paper to the Society. One thing he desired to thank Mr. Friel for was the nut; it was exactly what he had wanted for his screw for years. Mr. Friel's method of opening a space for a tooth with the simple wire was exceedingly useful, and he had been much struck by the exceeding lightness and delicacy of the wire Mr. Friel used, which had a great advantage, especially in a lingual arch. He did not understand how that arch was removed, but no doubt Mr. Friel would explain that later. He would like to know what Mr. Friel thought with regard to the advantage that such an arch possessed over an expansion plate. The general advantage was that which might be claimed for a fixed apparatus over a movable one; but an expansion plate possessed those qualities on which Mr. Friel rightly set value, of not transmitting movements of one tooth on to another. With an expansion plate worked by a screw one could correct such cases as those Mr. Friel had shown very easily, and at the same time not only effect the necessary lateral expansion but the straightening of the incisor teeth by means of the addition of a couple of very light spring fingers, or something of that sort, in the front. He would like to ask if a child was able to work Mr. Friel's apparatus of itself, or whether a large number of attendances were necessary. One of the chief difficulties which he himself had found in treating such cases was that the children were away at boarding school and could only come in the holidays, and one had to use some sort of apparatus which the child could work and which went on without the attention of the dentist and which was practically fool-proof. In that way, of course, the number of visits was very much reduced. He had been much impressed by the beautiful way the things were made and by the ingenuity and the technique displayed.

Mr. Harold Chapman considered that Mr. Friel had given the Society one of the best papers that it had had for a long time past. He had been very interested, even pleased, to hear Mr. Friel's condemnation of those mechanically perfect appliances which held the tooth so rigidly. He had felt for a long time that they were not the sort of things that were destined to exist for very long. Mr. Friel had mentioned to him some time ago the question of a nut and ratchet, and he had tried making them, but had not been very successful in doing so; he would like Mr. Friel to explain in more detail how he made them. Mr. Friel had been careful to explain how he obtained widening in the molar region, but the difficulty in many cases was to obtain the widening in the canine and first pre-molar region. He would like to ask Mr. Friel to go into a little more detail on that point. When he had seen Mr. Friel's arrangement for inter-maxillary anchorage on the molar band, it had occurred to him to ask why it was necessary to make it with several bends in it. It seemed to him it was quite sufficient to solder on a straight piece of wire to the band projecting backwards and downwards, which need not have any bend in it at all.

Mr. B. BULL asked if Mr. Friel had noticed any irritation of the sides of the tongue due to the apparatus.

Sir HARRY BALDWIN agreed with Mr. Badcock that the great difficulty in such cases was to get the children sufficiently often to attend to put in fixed appliances. Nearly always in London most of the work had to be done by means of plates, as the children were invariably miles away at school. The two kinds of expansion plate he had now in use were almost always a spring in the upper one and a Badcock screw in the lower—sometimes a twisted concertina sort of spring in the lower for expansion instead of the Badcock screw. But the treat. ment in most irregularity cases, excepting inferior protrusion cases, was general expansion, and a certain amount of pulling of individual teeth added to that. As far as he could make out from Mr. Friel's models, he got the space almost entirely for his teeth that were crowded out, or going to be crowded out, by pushing the front teeth forward. He did not know if that were so. He could not see that the apparatus would expand the whole jaw laterally very much, which was really the thing which was fundamentally needed. Mr. Friel had said his cases relapsed rather, and he (Sir Harry) should rather think it was because Mr. Friel had not expanded sufficiently laterally; that was to say, pushed the two sides of the arch away from each other sufficiently. One speaker had mentioned the difficulty in expansion cases of expanding sufficiently in the region of the canines. That was a difficulty on which he would like to have some light thrown —a better way of expanding the arch in the canine region of the upper jaw.

Mr. HIGHTON asked Mr. Friel if he had found it necessary to band his pre-molars or to put in any device on the lingual side to keep his arch in position.

Mr. FRIEL, in reply, said Mr. Northcroft had asked how he removed the lingual arch. He just pulled it out of the tubes with a pair of pliers, pulling evenly, first a little on one side and then a little on the other. It was a very springy wire which he used. It was Aderer's most elastic gold platinum wire. There were three types, and he had been using the most elastic type, and it did not seem to bend much. It was not advisable, if possible, to take it out until one had been working at the appliance for a couple of months, that is, until the teeth had all started to move. If one waited, it could be taken out quite easily. In some cases the difficulty was to keep it in and not to take it out. Mr. Northcroft also asked how the ratchet worked. When the nut is tightened up it just slides up the inclined plane of the ratchet and falls into place behind it. The nut cannot be twisted backwards unless the whole arch is pulled forward sufficiently for the nut to escape the ratchet. If there is an anterior attachment to hold the arch in place, the amount of tightening is greatly reduced, because when one gets to the top of the inclined plane of the ratchet the arch is very tight, but when it slips into place behind the inclined plane it is quite loose. So that probably at the actual moment of tightening one has to hurt the child slightly to get the arch tight. He had been asked to give an explanation about the expansion of canines especially. One of the simplest ways, if it is not possible to do it by altering the shape of the arch, is to solder a finger on the underneath side of it; this acts as a little spring and is made of a thinner material than the arch. One can periodically remove the arch and increase the pressure of the spring. In Mershon's article, published in *Items of Interest*, there were shown various fingers for such movements. Mr Badcock had asked him about the advantages of the method over expansion plates. He did not know how to answer. Personally he did not like expansion plates at all. He had never been successful with them. He thought the lingual arches were exceedingly clean, and they took up no room and did not seem to interfere with the chewing powers of the child at all. The only thing that was destructive to them was

toffee or caramels, and they were absolutely fatal. The child should be seen once a month. The appliance gets out of place if the visits are less frequent. Only in one case had he let a child tighten his own nuts. Children were inclined to be too vigorous and the molar anchorage gave way. They tightened it too much and too frequently. It was a most powerful appliance ; it would move anything. One would be surprised at the force it had, even when there was no anterior attachment at all. Mr. Bull had asked him about irritation to the tongue. The only cases where he got irritation were where the arch broke and the patient had taken the arch out of the tubes and had left the two tubes with their sharp points on them, which stuck into the tongue ; but it was a great lesson to the children not to eat toffee. Sir Harry Baldwin had suggested that the relapse mentioned was due to his (Mr. Friel) not getting lateral expansion. That was quite possible. One could get as much lateral expansion as one wished. It could all be done by lateral expansion if desired, but in the particular case referred to he had thought from the model that the anterior teeth had fallen back into the space, that they had all drifted round, that it was not a case for lateral expansion, that they had come lingually to one side. But one could get as much lateral expansion as one wished. Mr. Highton had asked if he used bands on the pre-molars to keep the arch in place. He did not. The only teeth he had used them on were the lateral incisors.

The thanks of the Society were accorded to Mr. Samuel and Mr. Friel for their papers, and the Society adjourned.

ILLUSTRATING MR. GEORGE NORTHCROFT'S COMMUNICATION.

ORDINARY MEETING.

An Ordinary Meeting was held at 11, Chandos Street, Cavendish Square, W., on Tuesday, November 18th, 1919, Mr. James Spiller, President, being in the chair.

The following casual communication was given :

Models of a Case Five Years after Treatment.

By Mr. George Northcroft.

Doubtless you all have received a copy of Dr. Bogue's paper on the early treatment of orthodontic cases, and I thought it might be interesting to present the result of treatment in one case that was first seen at the age of $7\frac{1}{4}$ years (1st model).

It was that of a girl, markedly postnormal, bottle-fed, but with no history of using a comforter, partial mouth breathing but no adenoids, with infraocclusion or an open bite in the incisor region. This latter made the prognosis much more favourable. Treatment was commenced January, 1913.

The case also illustrates the use of the lingual arch, of which I am able to show a model (2nd).

The case was completed by June, 1914, when all apparatus was removed, the jaws at that time being in stable equilibrium. The child was seen once more in May, 1915, when models were taken but no treatment was carried out (4th). The antero-posterior relation of the jaw remained normal but the left lower first premolar was erupting with a distal rotation of the inner cusp. As will be seen by models taken in July, 1919 (5th), this has resulted in an abnormality in the lower left premolar region but occlusion remains good, and on the whole I think must be considered a satisfactory result.

The President said that Mr. Northcroft, as usual, had made a very interesting communication. The speaker thought that it brought out very strongly the point that treatment early in life often saved a great deal more treatment at a later period. Even in cases which were quite bad, a very small amount of treatment given in time saved a much larger amount subsequently. He would like to know whether Mr. Northcroft had found the treatment, using reciprocal traction, difficult to apply at so early an age as $7\frac{1}{2}$ years, and also for how long he employed the treatment.

Mr. Northcroft said that he treated the case for one year, from 1913 to 1914. Reciprocal traction was used and he found absolutely no difficulty in using that method for children of that age. The child

was perfectly placid under the treatment, and the treatment did not cause any inconvenience at all. Occasionally there was talk of elastics being lost at meal-times but otherwise no complication arose.

Mrs. MELLANBY then read her paper entitled :

Experimental Evidence Demonstrating the Influence of a Special Dietetic Factor on the Development of Teeth and Jaws.

The research that I am about to describe to you was started under the auspices of the Medical Research Committee, with the idea that it might be possible by animal experiments to discover :

(1) The factors involved in the development of sound teeth and in the growth of the jaws in relation to the size and arrangement of the teeth.

(2) The conditions which affect the immunity of erupted teeth to caries and other diseases.

Needless to say, all I hoped to do was to contribute some *facts* which would help in elucidating these important and pressing problems.

The work has progressed to the extent that it is possible, as I hope to prove to you to-night, to state definitely that certain well-defined conditions are necessary for the growth of perfect teeth and jaws in puppies. The subject of caries remains untouched except in so far as it is possible to postulate that the more perfectly the teeth and alveolar processes are formed the less likely are they to suffer from caries and other disorders. In any case, it can be stated as a fact that puppies fed on a diet which produces sound teeth and well formed jaws are just those which are the most resistant to the diseases common to this type of animal.

Dental research must always aim in the first place at preventative measures. Unfortunately, when prophylaxis is discussed it only too often starts from the point of preventing defects in the teeth after eruption. In this work I have endeavoured to go further back by determining the conditions favourable to the *formation* of sound teeth and jaws.

Having now stated the object of the work, let me assure you that I am under no delusions as to what has been accomplished. It is only the beginning of work that may ultimately be regarded as of importance.

In a letter appearing in the *Lancet* early this year, Dr. Sim Wallace quotes a statement taken from an Editorial article of a dental journal. It reads as follows : " Until teachers of physiology in our medical schools recant the erroneous doctrines of diet and nutrition that have been the source of so much misplaced confidence during the last half century on the part of the anxious-to-learn public, little can be done."* The letter refers to the awful teeth of the people of this country. Now, partly as an explanation, and partly as an apology, I wish to say that I speak only as a physiologist, and whatever Mr. Wallace may be referring to in his onslaught on humble and ignorant physiologists, I am venturing into a den of lions with the best intentions of making amends for their general culpability. The fact is that physiologists when they have thought about the matter at all, have generally assumed that

* *Lancet*, February, 1919.

dentists knew everything there is to be known about teeth, and, in touching upon this subject, have advised their hearers to cleanse the mouth often and well, to give hard crusts to children and to prevent by all means bacterial decomposition of carbohydrates in the mouth. They have, in fact, been the gramophone of the dental profession.

While not wishing to deny that dental hygiene as commonly taught is very important, it seems to me that anyone thinking that the carrying out of this programme alone will result in perfect teeth is living in a fool's paradise. At no time in the country's history has dental hygiene been so developed, at no time have there been so many dentists, and at no time have the teeth of the country been so bad. The teeth of neolithic man were excellent. The teeth of the Esquimaux in his own country are very good. The teeth of civilised man are dreadful. Is there a simple explanation of these facts? If so, is it an explanation that can be acted upon? For, if it cannot be acted upon, it is of little value.

Before continuing, let me revert for one moment to my original statement that I speak as a physiologist only. I offer this as an excuse for my comparative ignorance of the literature, the terminology and many of the expressions used by dental experts. I am endeavouring to overcome this defect by assiduous reading, but my knowledge is still very imperfect.

The results to be described in this paper were obtained by experimenting on domestic dogs and I am quite aware that such work is open to criticism, especially as the results have not yet been extended to human beings. The critic can always say, "this applies to puppies but children are quite different." As a matter of fact the diet and the general metabolism of the domestic dog is as near that of the human being as any other living thing. Like man, the dog is omnivorous. As a member of a family it can lead a healthy existence. It is true that all the organs develop and degenerate more quickly than is the case in human beings, but any difference between the two is in general one of degree and not of kind. From some points of view monkeys may be better adapted for this type of work, but, on the other hand, the herbivorous diet of the monkey makes comparison with man difficult. Again it is especially difficult to keep monkeys in health under laboratory conditions however efficient the diet, and it is essential in all animal experiments to limit the factors being tested. For my purpose therefore, the dog would appear to be the best animal to use. I certainly realise that before the results can be definitely applied to man, the work must be repeated on him and he must remain the final test object. I maintain, however, that simply by observations on man alone, statistical or otherwise, it is almost impossible to gain much fundamental information. Surely the dental condition of civilised man to-day proves this.

Statistics of one observer gained simply by observations on human beings are so often refuted by similar statistics of another. Take as an example the statistical investigation of Lawson Dick* who made observations on the relative dental defects of Jewish and Gentile children in the L.C.C. schools in the East End. He has stated that the better feeding and nursing of the Jewish children

* *Proc. Roy. Society Med.*, vol. 9.

have not decreased the dental abnormalities. Hall, at Leeds,* making a similar investigation, says that the teeth of the Jewish children are infinitely better than those of the Gentile children of the same class, because they are better nursed and fed. Who is to judge which of these observers is correct ?

The fact is as already mentioned, that when making observations on human beings it is generally quite impossible to regulate your conditions accurately and to test each factor in turn. Every point ought to be closely followed up and investigated separately. It seems to me that this can only be done by animal experiments.

It is true that experimental workers have their controversies which often last for years, but these, as a rule, centre round questions of theories and hypotheses. When it is a question of fact, although sometimes not easy to settle, it is only the exceptional case that is not sooner or later decided by experimental effort.

To-night I want to place before you *facts* and these facts can either be supported or disproved by your own observations. You must be the arbiters.

Even animal experiments of the type I am dealing with are not easy to carry out satisfactorily. One of the greatest difficulties is that, feeding on the experimental and deficient diets necessary for this work, the resistance of the animals to infection is small and many suffer from distemper, mange, broncho-pneumonia and other diseases. Only by extreme care can this difficulty be kept within reasonable limits. If the conditions of feeding were made less strenuous, much of this difficulty would disappear, but in a research of this kind, it is important to get well defined results as quickly as possible. For this reason the pathological changes produced are often much more exaggerated than are commonly seen in human beings.

In most of the examples that I shall show you to-night the animals did not suffer from any acute illness and in many cases they were healthy throughout the experiment in spite of the deficient diet. On the other hand I can show you one or two examples of puppies fed on efficient diets which had very bad distemper and yet have sound teeth.

Another difficulty has been that in the desire to procure puppies we have had to accept all kinds of breeds and mongrels, with the result that, at least so far as growth is concerned, there has been tremendous variation. A difficulty like this, however, has its compensations. For, if all the results can be made to fit in, in spite of this difficulty, obviously they can be viewed with greater equanimity than would be the case if the experimental animals were all of the same size and type.

It has been usual in this research to work on litters of puppies, and while keeping them in comparable hygienic conditions, to make slight variations in their diets, and to observe the effect on the teeth and jaw development. Most of the experiments have been repeated again and again so as to eliminate possible sources of error that might arise through variation in rate of growth, attacks of illness, and other conditions. Altogether about 280 puppies have been used in the course of this research, which is a development of my husband's work on rickets.

* Hall, of Leeds. Private communication.

I understand that some members of the dental profession are a little sceptical about the work. Perhaps this is partly so, because the results point to the importance of a vitamine in the diet of the young. Vitamines are apparently viewed with suspicion by some who have no direct acquaintance with such things. There is now no doubt whatever of their existence as is proved by work undertaken from many points of view, physiological and pathological, experimental and statistical. Perhaps it will be well for me to say something to you to-night about these substances.

Only very small quantities are necessary in the diet, amounts quite out of proportion to their importance, hence the failure till recently to realise their presence. For this reason they must be put in a nutritive category different from that which comprises the better-known foodstuffs, such as proteins, carbohydrates and fats.

Let it be stated at once that there is at present no knowledge concerning their chemical nature.

The name vitamine was given to these bodies because Funk claimed to have isolated one member of the group and found that it was an anime. Although these results have since been shown to be incorrect, yet the name has struck the imagination of the public and it is certainly more concise than the term " Accessory Food Factor " used by Professor Gowland Hopkins, who was the first to appreciate fully the great importance of these substances as the result of his pioneer work.*

At the present time three separate vitamines are known.

1. Antiscorbutic.
2. Water Soluble B or antineuritic.
3. Fat Soluble A.

They are associated with natural foods and can only be recognised by what they do to the animal body, or by what follows when they are specifically absent from the diet.

The antiscorbutic factor is that one which, when absent from the diet gives rise to scurvy. In this disease there is generally a rapid loss of weight, pains in the bones and elsewhere, hæmorrhages, loosening and falling out of the teeth, and easily fractured bones. Most of our knowledge of the antiscorbutic factor has resulted from the work of Holst and Frölich,† who first produced the condition in guinea-pigs, which are very susceptible to the lack of this factor. The investigation has been developed by a band of workers at the Lister Institute and in America. Recently Wells and Zilva‡ have shown that the absence of this factor also produces defective changes in guinea-pigs' teeth, especially in the pulp.

The antiscorbutic vitamine is fairly readily destroyed by heat, the time factor being as important as that of temperature.§ It is found in the largest quantities in fresh foods, especially in fresh vegetables and fruit—the orange and lemon being particularly rich in this respect (see Table A).

Water Soluble B is probably identical with the antineuritic or anti-beri-beri factor. Eijkmann,‖ a prison doctor in the Dutch Indies (about 1897), observed that his fowls developed the same symptoms

* *Journal of Physiology*. 1912,
† *Journal of Hygiene*, 1907.
‡ *Proc. Royal Society Med.*, 1918.
§ Delf. *Biocham Journals*, 1918.
‖ *Arch. für Path. Anat.*, 1897.

of polyneuritic that were so widespread among his prisoners. Having thus accidentally found a suitable experimental animal, he soon showed that the condition resulted from their polished rice diet. On adding to this diet the rice polishings or an extract of these, a cure was rapidly established. The aleurone layer and more particularly the germ of cereals, is rich in the antineuritic vitamine while it is absent or deficient in the endosperm.* The discovery of Water Soluble B, which is now realised to be identical with the antineuritic vitamine, resulted from growth experiments on rats carried out in England, America and Germany. It is found that in order to bring about normal growth in young rats two distinct vitamines are necessary in addition to water, proteins, carbohydrates and the antiscorbutic factor. One of these substances, Water Soluble B, has a very wide distribution in nature and is present in the majority of natural foods examined. It has a great resistance to heat. (See Table B.)

The second factor said by MacCollom† and others to be necessary for growth has been called *Fat Soluble A*. (The name is not good because it is not always found associated with fats, it is not even always soluble in fat solvents.)

E. Mellanby's work‡ on the growth of puppies has called this result in question. Puppies seem to grow well in its absence or when present only in traces. The rate of growth appears to have but little relation to the amount present. From these experiments, however, it was found that, although puppies grew when Fat Soluble A was deficient in their diet, yet the growth and more particularly the growth of bone, was not normal and rickets developed.

Young rats and puppies therefore apparently do not re-act similarly with regard to this factor and it seems more likely that children would behave in the same way as puppies.

This factor is present in most animal fats and, as the result of the rat experiments, it is said to be absent in vegetable fats. E. Mellanby's work suggests that it is present to some extent in peanut oil and possibly to a less extent in some other vegetable oils. It is certainly deficient in linseed, babassu, palm kernel, rape seed and hydrogenated fats.

It is present in green vegetables.

It appears to be fairly resistant to heat, lying in this respect between the antiscorbutic and antineuritic factors. (See Table C.)

Vitamines have one important property in common in that only vegetable life can synthesise them. There is general agreement that any stores found in the animal body have arrived there as the result of eating vegetable matter. For instance, the Fat Soluble A in cow's milk undoubtedly comes from the grass the cow eats. Of the three factors the most widely distributed is Water Soluble B, and with a mixed diet, there is no danger of a deficiency of this vitamine. Nor is there much real danger of a deficiency of the antiscorbutic factor so long as the food eaten has not in its preparation been subjected to prolonged heating.

It is, however, very easy to choose a diet in which Fat Soluble A

* Chick and Hume, *Proc. Roy. Soc.*, 1917.
† *Journal Bio. Chem.*, 1915.
‡ *Lancet*, March, 1919.

is deficient for, on the whole, it is the good things of life such as whole milk, eggs, butter, suet, fish fats and green vegetables which contain adequate supplies of this substance. A diet consisting largely of bread, porridge, rice and other cereals, lean meat, margarine, jam, tea, sugar, etc., all very popular articles of consumption, especially among the poor, contain very little or no Fat Soluble A. I hope to put before you evidence which suggests that the deficiency of this factor in the diet of the young may be responsible for many of the defects of modern teeth and jaws, and possibly indirectly for the prevalence of caries among civilised communities. (See Table D). In other words, however much calcium there may be in the diet, it cannot be used by the tissues to the extent necessary for the construction of normal teeth and jaws, unless Fat Soluble A, or something with a similar distribution, is also present.

Puppies receiving a diet deficient in this respect but efficient in other respects show the following :

1. Poor and abnormal growth of the jaws and alveolar processes, in both of which bone is largely replaced by osteoid tissue. (See Fig. 1.)

   (Professor Shattock has very kindly examined some of my specimens with great care and I have his authority for saying that the tissue seen in these specimens is osteoid tissue similar to that found in human rickets and some other diseases.)
2. Teeth, especially the lower incisors, irregularly arranged. (See Fig. 2.)
3. A delay in the eruption and a slowing of the eruption of the permanent dentition. Often there is a delay in the shedding of the deciduous teeth. (See Fig. I., Paper 1, *Dental Record*, January, 1919.)
4. A delay in the calcification of the enamel which when formed is defective to a greater or less extent.
5. Defective dentine which is small in amount for the age of the animal and shows many interglobular spaces. (See Fig. 3 and microphotograph kindly taken by Mr. J. H. Mummery, Fig. 4.)
6. A decrease in the weight of the teeth compared to their size, the total calcium content being low. (See Table E.)
7. That the greater the rate of growth of the animal, the greater are the teeth and jaw defects produced by the absence of Fat Soluble A, that is to say, the effects produced are specific and are not comparable to those of acute illness (see Fig. 5) (compare the lack of this factor with the lack of the anti-scorbutic factor in this respect).
8. A much diminished resistance to diseases such as distemper, mange and broncho-pneumonia.

If the diet contains an efficient supply of Fat Soluble A but is otherwise the same, then a very different picture is presented, the teeth, alveolar processes and jaws are beautifully calcified and the former are in general regularly arranged.

Experimental Methods.

It has been usual to start the feeding of the puppies on the particular diets when they were between five and nine weeks old, except in particular cases when I wished to determine the effect

of the mother's diet on the puppies *in utero*, or in very young bottle-fed puppies.

In comparative experiments all the puppies belonged to the same litter, and the conditions of kennelling, exercise, and general hygiene were kept strictly comparable. The basal diet ultimately chosen was one found by experience to be palatable, and to allow good growth. It consisted of :

Separated milk (175–250 cc. p.d.)
White bread (ad. lib.)
Yeast (5–1-gr. p.d. Water Sol. B)
Orange juice (25-5 cc. p.d. antiscorbutic)
Sodium chloride (1 gr. p.d.)
In most cases lean meat (5–5 gr. p.d.)

Note.—This diet will be referred to in this paper as Diet A.

The various substances to be tested were added to this diet, which in itself is practically devoid of Fat Soluble A. It must be noted here that the diet in all cases was soft and pappy—the bread being soaked in the separated milk and water.

Records were of course always kept of the weight of the puppies, of their general state of health, and in addition the following data were obtained :

1. The time of eruption of the deciduous and permanent teeth and also the time of shedding of the deciduous teeth.
2. At intervals X-ray photographs were taken of the teeth developing in the jaws. This is not an easy matter in puppies and my results are not as successful as they ought to be.
3. In some cases casts were made to see if subsequent treatment could remove the irregular arrangement of the teeth. (I am very grateful to Mr. Tarry, of the Dental Manufacturing Co., for his help in this and other technical problems.)
4. In other cases teeth were extracted during the course of the experiment with the idea of testing the effect of changing the diet on the remaining teeth.
5. The animals were killed at varying ages, usually after being dieted for from three to six months, but in comparative experiments at the same age.

Immediately after death the jaws were removed and the bulk either preserved in 10 % formalin or dried. In most cases slices of the lower jaws were put into special fixatives and preserved for histological purposes, while one of the carnassials (usually the upper) (PM^4) was removed from the jaw, measured, weighed and its total calcium content estimated chemically.

In some cases ground sections of the teeth and jaws have been made by Weil's process, and in other cases decalcified sections have been prepared. For this purpose it has been usual to use the central part of the lower carnassial (M^1). (For position see Fig. 6.)

Experimental Results.

I want to-night to draw your attention especially to the growth of the jaws, the type of bone forming the jaws and the alveolar processes, the irregularities or otherwise of the teeth and particularly the incisors of the lower jaws.

I will take the following experiment as an example to demonstrate to you. It must be remembered that the hygienic conditions were entirely comparable. (See Table F and Fig. 7.)

16 17

FIG. 1. Drawings taken from Sections of Teeth and Jaws of puppies of the same litter.
(16 no Fat-Soluble A, 17 Fat-Soluble A in diet.)
Note differences in bone formation of jaws and alveoli
(16 osteoid tissue; 17 normal bone).

FIG. 2. Photographs showing Irregularities of Incisors.
A Fat-Soluble A (regular). B No Fat-Soluble A (irregular).

FIG. 3. Microphotograph showing Interglobular Spaces resulting from diet moderately deficient in Fat-Soluble A.

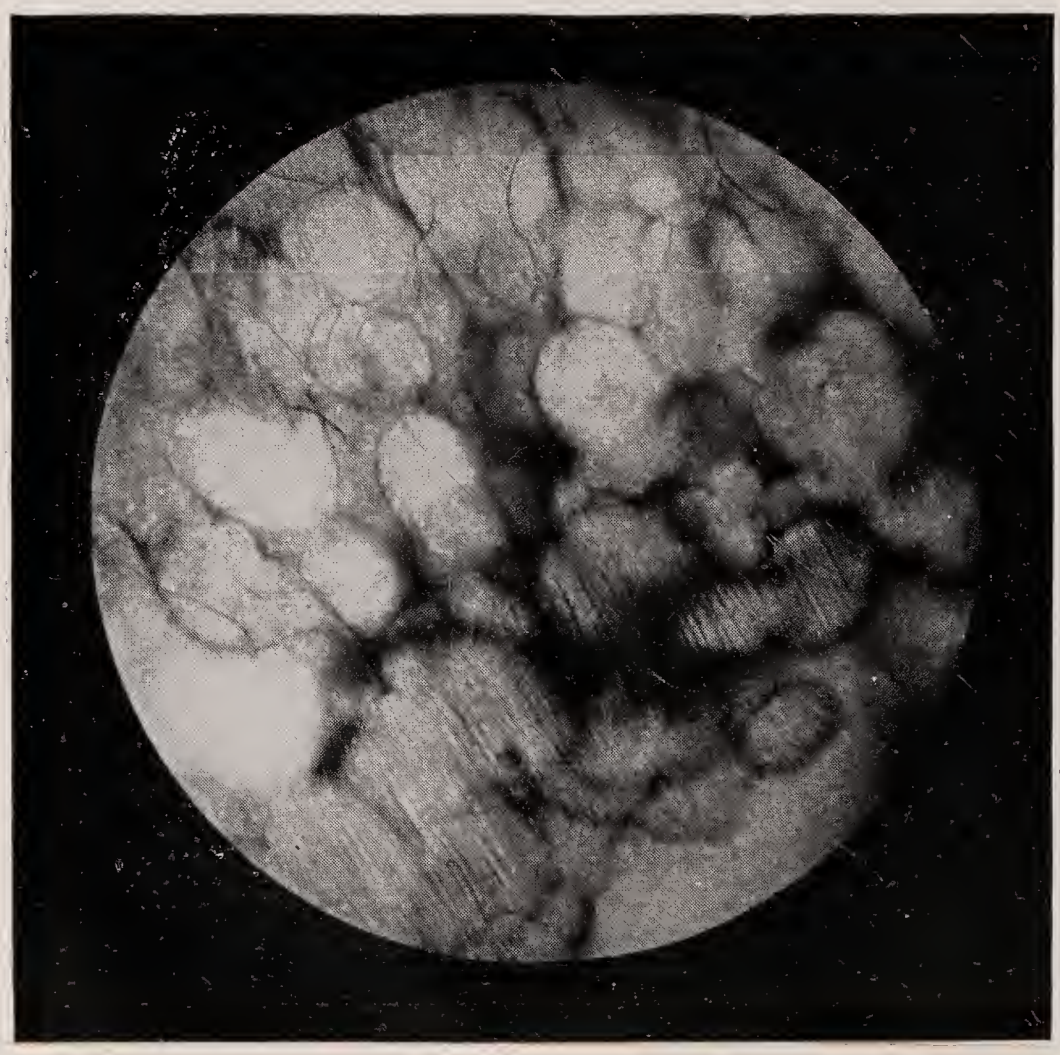


FIG. 4. Micrograph (taken by Mr. J. H. Mummery) showing large number of Interglobular Spaces near neck of tooth resulting from diet very deficient in Fat-Soluble A.

FIG. 5.—Photograph showing the greater the growth the worse the teeth and jaw formation (puppies of same family, killed at same age).

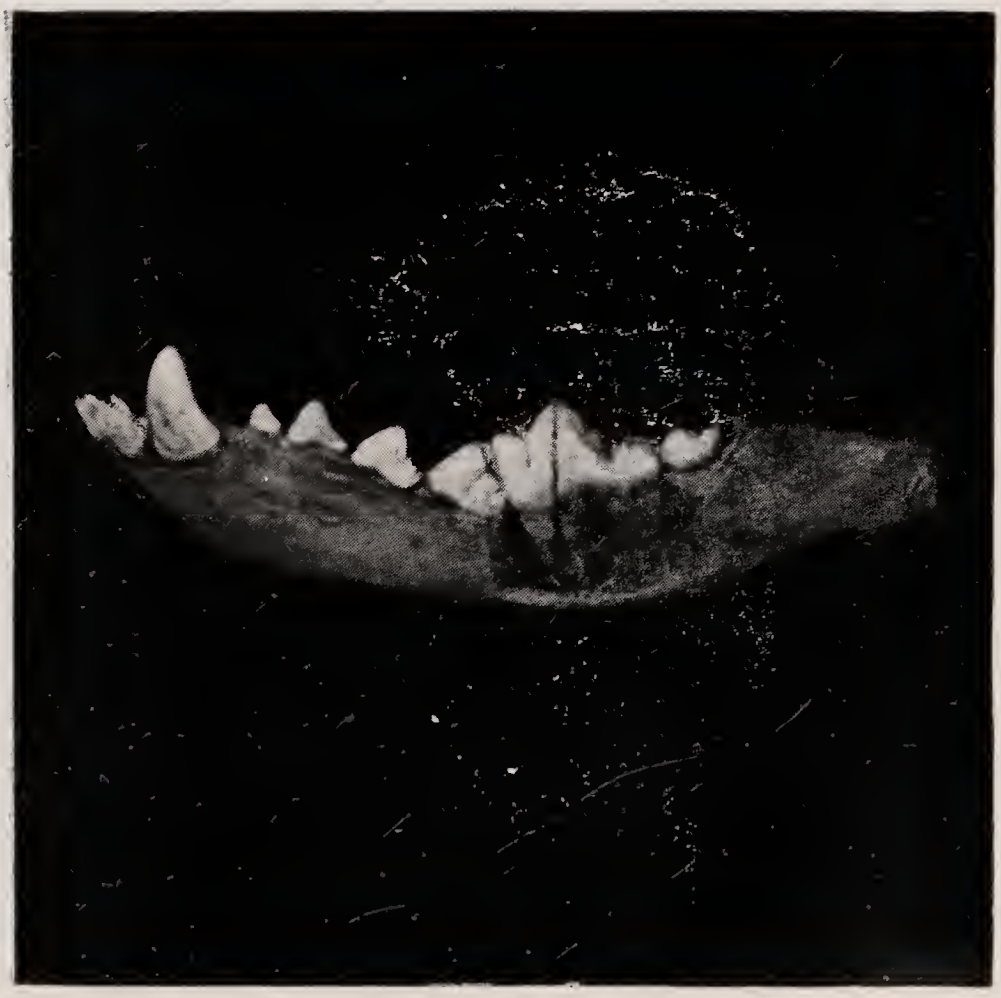


FIG. 6.—Photograph showing region of the carnassial used for sections treated by Weil's method.

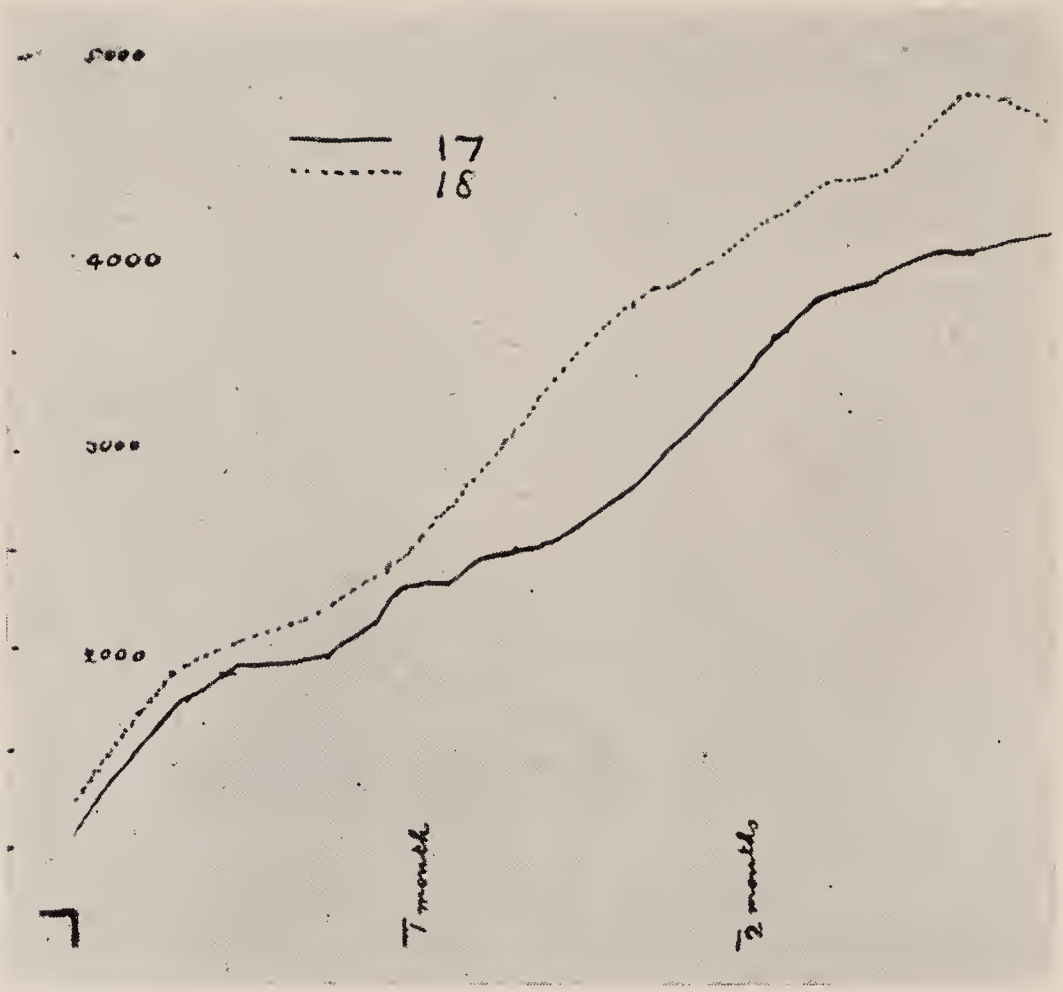


FIG. 7.—Curves showing the rate of growth of two dogs, the diets of which were similar except that 16 received linseed oil and 17 cod-liver oil.

Ordinates = weight of dogs in grams.
Abscissae = time in months.

ERRATUM.—18 in illustration *should read* 16.

In 15 and 16 of Table F, where the fat eaten was linseed oil, very bad rickets developed, while 17 on cod liver oil was normal in every way.

TABLE A.

Some Examples of the Distribution of the Antiscorbutic Vitamine.

Present.	*Absent.*
Orange juice.	Wheat.
Lemon ,,	Maize.
Swede ,,	Rice.
Germinated pulses.	Dried peas.
Tomatoes.	,, lentils.
Cabbage.	Tinned meats.
Beans (fresh).	Yeast.
Etc.	Meat extract.
	Etc.

TABLE B.

Some Examples of the Distribution of Water-soluble B (Antineuritic Vitamine).

Present.	*Absent.*
Wheat Germ and pericarp.	Endosperm of grains.
Maize ,, ,,	Butter.
Rice ,, ,,	Cream.
Eggs (dried and fresh).	Codliver oil.
Peas (,, ,, germinated).	White flour.
Lentils (,, ,, ,,)	Polished rice.
Nuts.	Etc.
Liver.	
Sweetbreads.	
Etc.	

TABLE C.

Some Examples of the Distribution of the Fat-soluble A Factor.

(Rat-feeding Experiments.)

Present.	*Deficient or Absent.*
Codliver and	Lard.
Fish oils.	Vegetable oils.
Butter.	Hardened fats.
Animal fats (except lard).	Margarines (veg. fats).
Milk.	Skim milk.
Eggs.	White flour.
Cheese (whole milk).	Cornflour.
Cabbage.	Tea.
Lettuce.	Sugar.
Spinach.	

TABLE D.

The Effect on the Teeth and Jaws of some of the Foodstuffs Tested.

Good Teeth and Jaws.	*Defective Teeth and Jaws.*
Codliver oil.	Lard.
Butter.	Most vegetable oils tried.
Animal fats (except lard).	Skim milk.
Milk.	White flour. Rice.
Eggs.	Oatmeal. Sugar.

TABLE E.

No.	*Diet*	*Weight of dry Carnassial*	*CaO in Carnassial*	
16	A + 10 cc. linseed oil per diem	0.472 grams	0.154 grams	same family and same age at death
17	A + 5 to 7.5 cc. cod. liver oil per diem	1.129 ,,	0.395 ,,	
20	A + 10 grams lard per diem	0.779 ,,	0.261 ,,	same family and same age at death
21	A + 10 grams butter per diem	1.084 ,,	0.381 ,,	
22	A + 10 grams babassu oil per diem	0.751 ,,	0.265 ,,	

TABLE F.

EFFECT OF FAT-SOLUBLE A ON THE TEETH AND JAW FORMATION OF THREE PUPPIES OF SAME FAMILY.

No.	*Age*	*Diet*	*Jaws*	*Arrangement*	*Enamel*	*Dentine*
15	27 weeks	A + 10 cc. linseed oil and extra sep. milk	Spongy (osteoid tissue)	Irregular	Poor	Poor. Inter-globular spaces
16	27 weeks	A + 10 cc. linseed oil per diem	,,	,,	,,	,,
17	28 weeks	A + 5 to 7·5 cc. codliver oil per diem	Hard compact	Regular	Good	Good

Hygienic conditions the same in each case.

From the spongy nature of the jaws, and alveolar processes, it seems possible that in children, under similar conditions, the teeth might become irregularly arranged and the jaws defective in shape owing to the movements of the tongue and other muscles, especially if hard food were eaten.

Note.—Osteoid tissue in rickets and some other diseases replaces true bone, it is spongy in nature and contains only a comparatively

small amount of calcium, and hence, after treatment by Weil's process, it takes up the carmine stain, which would not be the case if the tissue were well calcified. (See Fig. 1.)

Demonstration specimens illustrating the following points were shown :

1. Poor and abnormal growth of the jaws, and alveolar processes.
2. Teeth irregularly arranged.
3. A delay in the eruption of the dentition and a delay in the shedding of the deciduous teeth.
4. Defective enamel.
5. Defective dentine showing numbers of interglobular spaces.
6. That the greater the rate of growth of the animal the greater the jaw and teeth defects produced by absence of Fat Soluble A.

These demonstration specimens consisted of :

Puppies' jaws.
Drawings.
Histological sections of jaws and teeth.
X-ray photographs.
Lantern slides.

I hope I have been able to prove to you to-night that, in the case of puppies at any rate, Fat Soluble A or something with a similar distribution to that substance, is one of the principal factors involved in the normal growth of the jaws and teeth.

Up to the present I have only mentioned Fat Soluble A as if it could be considered apart from all the other elements of the diet. This is a wrong attitude. Criticism against much of the research on vitamines is that it has been directed along these confined lines. These substances and their actions must always be considered in conjunction with the physiological condition of the animal, its age, rate of growth, general metabolism, and more particularly with the other elements of the diet. It would take too long to discuss these matters fully, but it may be stated here that the younger the animal the more essential is Fat Soluble A, and that the more rapid the rate of growth the greater the quantity needed to keep that growth normal. Many other points of interest in this connection are at present being investigated.

Again, whether Fat Soluble A works directly on the ameloblasts and other calcium depositing cells, or whether it has an indirect effect by stimulating some intermediate tissue, must for the time being remain simply a case of conjecture. There is of course evidence that certain endocrine organs such as the pituitary, the parathyroid and the thymus glands, are involved in calcium metabolism, but there is no experimental evidence that Fat Soluble A has any specific effect on these bodies.

We are only at the beginning of our knowledge of vitamines and their actions, but information is rapidly accumulating. I hope our comparative ignorance will not make you sceptical of their reality.

Having now seen the results of the animal experiments, we must ask ourselves whether they are in agreement with human experience or are they contrary to common sense ?

It is not an easy question to decide, and probably I am both ignorant and biased, but I must confess that they seem to me reasonable.

A perusal of a list of the substances containing Fat Soluble A makes it clear that civilised conditions, and more especially those conditions met with in urban life, exaggerate the part in the dietary by just those substances which are deficient in this type of accessory factor. (Compare Tables C and D.)

Our diet,particularly that of the poor, is now more than ever made up of cereals such as wheat, rice and oats. Meat and animal fats tend to play a smaller part. Vegetable fats, in the form of margarine, are superseding butter, whole milk is being more and more excluded from the diet of the poor. The normal way to treat a crying child is to give it a crust of bread. We have passed through a period when breast-feeding was not very popular. The vitamine theory would also seem to explain why the Esquimaux in his own country, where flesh and blubber are the staple articles of diet, has such excellent teeth, while the inhabitants of Chili, who live largely on cereals, have teeth which are much less sound.* We can also understand why the teeth of the fish-eating communities are so good. Further, if these results are true and apply to man, it ought to be safe to prophesy that the teeth of the children of Austria, Poland and other places which have suffered so terribly from the war, will be very defective owing to the deficiency of milk, eggs, animal fats and other foods containing Fat Soluble A.

I have endeavoured to supply you with evidence that the origin of many of our dental defects is, possibly largely dietetic and that the factor at fault is very definite in its action. A writer in the *Lancet* says, " Experience has taught me that there is no royal road to the prevention of dental caries. To believe that our nation will alter its diet to save its teeth is chimerical. The chief safeguards are cleanliness, inspection and early treatment." This is a very sad forecast, and I hope an untrue one.

If my work and its application to human beings is correct one important cause of unsound teeth and poor growth of the jaws is very well defined and does not involve the use of that hopeless expression " defective hygiene," and the remedy would also appear obvious. With definite knowledge, definite instructions can be given and acted upon.

The result of acting on such instructions will be that the diet will remain a normal one and the child will be healthy. Finally, the time when this feeding is important from the point of view under discussion is the period of parental responsibility, and it ought to be very easy to keep the diet as palatable as it ever has been and yet arrange its Fat Soluble A content so as to produce sound teeth and normal jaws.

The PRESIDENT said that the Society would wish to thank Mrs. Mellanby very sincerely for this interesting and valuable paper. It was the first time that the Society had been honoured by a lady coming to read a paper, and he hoped it would not be the last.

Mr. NORMAN G. BENNETT said that he did not know why he found himself called upon to open the discussion, except that the Hon. Secretary had asked him if he would undertake the task and he had said " No." He had no special qualifications, unless it was that he had had some little share in inducing Mrs. Mellanby to undertake this work, and a very little share also in assisting her in its earliest stages.

* J. H. Mummery. *Trans. Odonto. Soc.*, Vol. 2, N.S.

Mrs. Mellanby had brought before them a number of facts, but he thought perhaps it would be better if, in opening the discussion, he confined himself in the time available to trying to define the issue and to showing what was the relationship between the facts that Mrs. Mellanby gave them and what they had hitherto regarded as facts in connection with hypoplasia, development of bone, and liability to caries.

Mrs. Mellanby stated that the absence of Fat Soluble A caused a condition of the teeth and bones which was at any rate indistinguishable from rickets ; that was to say, they had in the bones an osteoid tissue and other characteristic features, particularly deficient calcium content in the teeth and in the bone, and as a corollary to all this—or, rather, a corollary to the condition of the bone—they had the crowding of the teeth in the jaws—insufficient space in the jaws for the teeth—so that any diminution of the size of the teeth due to lack of Fat Soluble A was paralleled to a greater degree by the diminution in the size of the jaw, otherwise there would not be the crowding. It seemed to him that the hypoplasia shown, produced in a sense artificially was different from what they were familiar with in teeth. What they knew in teeth best was the hypoplasia which occurred in those portions of the permanent teeth which were calcified during the first year of life—from birth up to the end of about the first year—affecting about one-third of the central incisor and the morsal surfaces of the first permanent molar, and occasionally the second deciduous molar. He had never been convinced himself that that condition was the result of rickets ; there might be rickets or there might not, but he thought all that they had in the way of facts to go upon was that this condition was associated with errors of metabolism due to defective diet or to illnesses, which produced effects similar to the " tide-marks " in the nail. Corroboration was found in the fact that on other portions of the teeth occurring in later life they got the lines which were characteristic of other attacks, such as measles and scarlet fever. As he had said already, that hypoplasia appeared to be different in character from the hypoplasia seen in the teeth shown by Mrs. Mellanby ; he did not draw any definite conclusions from that, he merely noted it.

As regards liability to caries, that, whatever it was, must surely be due to one of two factors, one of them internal and the other external, an internal factor which had produced some defect in the structure of the teeth, and an external factor such as diet and variations in the character of the saliva. It was known that many dentists who had studied the subject had been convinced hitherto that variations of the food—the carbohydrate food of one kind or other—and the limitation of food of a detergent character were the main causes of caries at the present time. He might remind them of the researches of Black, who showed, or thought he showed, that in the structure of teeth which were on the one hand hard and on the other soft, or clinically appeared to be soft, at any rate to the application of instruments, there was no difference in the chemical composition, that the calcium content was the same in both ; and they would contrast that with what Mrs. Mellanby showed them in these rachitic teeth, where the calcium content was lower than normal. Those experiments of Black had not been definitely confirmed and they had to set against them the work of Pickerill, who showed that, whatever the chemical composition might be, there was a marked physical difference—in other words, that there were definitely hard teeth and soft teeth—and, indeed, it was not surprising that even though the chemical composition might be the same, the physical structure was markedly different. It seemed to him that possibly they had to revise their view of what rickets could produce in the human body. They had to consider not only the gross defects referred to by Mrs. Mellanby at the ends of the long bones and so on—but it was possible at any rate that those slight defects in teeth, which made one tooth softer than another, even

though its composition might be the same, were possibly the result of rickets, or at any rate of the diminution of Fat Soluble A in the diet.

As regards the jaws themselves, it was interesting to learn that in all these cases the bone was of an osteoid character, not fully formed bone. That was particularly interesting to them in that Society, because they were more concerned there with the development of the jaws and of the teeth in the jaws than with the physical structure of the teeth and the liability to caries ; and Mrs. Mellanby raised a very interesting question as to whether in the case of all the children they had to deal with who showed deficient growth of the jaws, the structure of the bone of those jaws was defective and of an osteoid character. If it was so, it was obviously a provision of nature to aid the hard-working orthodontist in moving the teeth about the mouth ! That was an interesting point, but he did not propose to draw any deductions. It was the privilege of anyone opening a debate that he need not draw deduction but only open up fresh problems and, if possible, increase the complexity of the problems which the reader of the paper had already formulated. He hoped, therefore, that there would be a good discussion as to whether hypoplasia produced in Mrs. Mellanby's experiments was comparable with the hypoplasia they were familiar with in humans, and whether they could regard it as due to rickets or absence of Fat Soluble A, or as some ill-defined result of some abnormal process of metabolism other than rickets.

Professor ARTHUR KEITH said that he had listened to Mrs. Mellanby's paper with the greatest interest, but he was afraid that he had very little to add to the discussion beyond acknowledging what he had himself learned. There was no doubt about it that this subject of the vitamines opened up altogether a new vista in medical knowledge and compelled them to revise their ideas as to a considerable part of the mechanism, not only of the jaws, but of the whole body. He might indeed be led on to refer to a much wider problem, bringing in the function of the bowel and the fact that nature had found a very cheap way of digestion and had set aside a part of the bowel to do the digestion cheaply. While they might only have thought of flour and starch and so on, nature was utilizing all the enzymes for the material she wanted within our bodies. Mrs. Mellanby, therefore, had opened up a very big subject. The whole question of the vitamines was going to form a very great chapter in physiology and medicine, and, although up to the present he believed, only three vitamines had been isolated, he took it that these three, like the elements oxygen, hydrogen, and nitrogen, which were thought at first to be the whole list, and proved to be only the beginning, were but the first of many others to follow. The lesson to be learned, however, was that there was a direct action upon our systems.

He fully recognised the extraordinary importance of this work. When, however, he came to closer quarters with the work in the light of orthodontics, he was not quite sure that he would agree with all its conclusions. He had only looked at the matter superficially, but this condition which Mrs. Mellanby had produced artificially was one with which everyone who had been enabled to study the animals of the Zoological Gardens was perfectly familiar. The jaws were got exactly in the condition as described in this disease—this Fat Soluble A disease or acute rickets. In these deformed jaws and contracted palates there was a deficiency of bone laid down but no deficiency that he knew of, in the structure, and the problem for them in England to-day was to discover the true cause for this condition. This condition of deformed jaws and contracted palates was not rickets, though it might be associated with rickets and a day might come when a substance would be isolated which would be recognised as the cause of this condition. Some of those present might remember that he read a paper before that Society some years ago showing the extraordinary influence that some substances in the pituitary—and there

were some fifty or sixty different bodies in the pituitary, all of them acting—could exercise in bringing about growth in a very definite way and also that the growth could be altered. These were conditions totally different from the condition they were considering that evening, and here he agreed with Mrs. Mellanby. Just before she read her paper he was throwing out to her certain different ideas as to how vitamines acted on the system. He had excluded the organs of internal secretion, and he was drawn between two other ideas. In the intestinal canal there were millions of minute glands, and to this day they had not the ghost of an idea what they were for. Lately his ideas on the subject had been drawn towards the bowel, and he thought it possible that somehow the vitamines were really used up in the intestinal machinery, and that the effect which was seen was produced by some deficiency in the liver. He had thrown that idea out to Mrs. Mellanby and she had told him that her husband had thought of a similar possibility. Probably, then, this defect was produced by some deficiency in the liver. But Mrs. Mellanby for the first time had shown that the absence of a very slight food factor would produce this enormous result and it might be that further evidence would go to show that there were other vitamines also concerned in the production of the condition called deformed jaw and contracted palate.

Dr. Sim Wallace said that he felt some diffidence in rising to state some other cause than the one presented by Mrs. Mellanby ; nevertheless, he felt that he must try and put another aspect on some of the things that had been stated that evening. He was quite willing to agree with Mrs. Mellanby that anomaly of Fat Soluble A would develop all the particular things that she had indicated—rickets and delayed calcification of the teeth and jaws—but he was not willing to agree in the very slightest with the suggestion that lack of Fat Soluble A was responsible in any way for dental caries in the children of the present day. In view of what they knew already and the facts revealed by Mrs. Mellanby's paper, they would rather conclude that it was an *excess* of Fat Soluble A which gave rise to dental caries. Mrs. Mellanby had referred to the teeth of neolithic man as being excellent—he was sure that Professor Keith would agree with that too—and relatively free from caries, but since then there had been a positively enormous and appallingly destructive increase in the amount of cows' milk supplied to children. The separated milk was not given to children ; it was given to the calf and the pigs, and these, so far as he knew, had excellent teeth. Then, among the rich, articles of diet like cream and butter and eggs and so forth were more freely consumed, as Mrs. Mellanby had shown, and he thought they might reasonably ask if this was the case why the teeth of the rich were rather worse than the teeth of the poor. That, so far as children were concerned, had been shown by statistics and, among school medical officers, it was a recognised fact that the better the school, the worse the teeth. But, whether among rich or poor, the fact was that 95 per cent. of the children had got carious teeth. It might be claimed that this was due to the fact that though the poor did not get so much cream and butter, they got more of the fat of meat, whereas the rich did not buy fat meat for their children, or, if they did, the children would not eat it. The poor might possibly get more fat in that way. At any rate they were more addicted to buying knuckle bone and the scrag-end of meat which they boiled down with vegetables and made a palatable and cheap soup. This source possibly provided the excess of Fat Soluble A which seemed to be necessary to destroy the teeth. Fish also was a relatively cheap form of food with which the poor supplemented a farinaceous diet. They got fish, like the herring, cheaply, and perhaps from this source also came the extra Fat Soluble A which appeared to act injuriously if taken in excess.

He wanted now to refer to a fact with which perhaps Mrs. Mellanby was not acquainted—namely, that the calcium content of the tooth

had got practically nothing to do with the commencement of caries or otherwise. They knew from Black's investigation that the first permanent molar was if anything a little more calcified than the lower incisor, but the lower incisors were practically never affected by caries, and the first permanent molar was practically always affected by caries. With regard to Mr. Bennett's reference to Black's investigations, he thought that he (Mr. Bennett) was mistaken in saying that the investigation was not confirmed ; it was confirmed by Sir Charles Tomes, somewhat to his (Sir Charles's) surprise. It was not only a chemical but a physical investigation. Blocks of the enamel were taken out and subjected to physical tests. With regard to irregularities and crowding, those who consumed excess of Fat Soluble A, rich or poor, had irregularities of the teeth most frequently. He had seen definite statistics, and his impression from them was that the difference was practically nil. The speaker went on to quote from an article in the *Lancet*, of October 18th, on the work done on the subject of rickets and the mandible at the Massachusetts Hospital School for Crippled Children :

" Fifteen children were examined and plaster models of the mouths were taken. A theory has been held that rickets tends to produce malformation of the jaws but a careful study of these cases gave no support whatever to this view ; indeed, several children were possessed of remarkably well-formed arches. The softening of the bones is a characteristic of the disease but the form which the bone takes on as a result of rickets is not typical of the disease but rather expresses the mechanical force acting upon it.

" ' The mandible,' Dr. H. K. Hatfield is quoted as saying, ' is a plastic structure in health and under the stress of mastication, preserves its form ; hence, in softening of the bone and with uniform muscular weakness, no change in the bone necessarily occurs. On the other hand, the introduction of an artificial force or a change in muscular action will alter the equilibrium determined by function and produce deformity.' "

In conclusion he would revert to the question of dental caries. The first thing physiologists should learn was that dental caries began from the outside of the tooth and the intensity of the active process was in no way concerned with the chemical composition of the teeth. If anything was definitely proved, that had been. Finally, the control of the parasite came from outside of the tooth and was dependent on the general hygiene, about which physiologists appeared to have much to learn.

Mr. S. P. Spokes said that he had been extremely interested in the paper. The work was previously known to him to some extent, and he was very pleased to be there that evening. Mrs. Mellanby had said that she feared she was entering into a den of dental lions, but he thought that perhaps some of them were born in captivity and were quite toothless and perhaps rachitic. He did not think she need feel any great fear on that point. But he felt that Dr. Sim Wallace had not treated the paper with absolute fairness. Mrs. Mellanby had approached this subject from the purely scientific point of view. She had been content to lay before them the facts without making any deductions. They had been left, except in one or two incidental respects, as, for example, with regard to the irregularity of the teeth, to draw their own inferences and deductions later on. It was perhaps in a sense a collection of statistics which she had given them, and, although she had alluded somewhat slightingly to the presentation of statistics, statistics of observations which had been made on children's mouths in the past were useful, inasmuch as they might suggest certain lines of investigation to the physiologist, and the physiologist's facts in their turn might serve all the purposes of statistics to those working on other lines. Therefore there was no need for them to quarrel with terms of that sort. But the author had not been content to show them why this came about. She had gone on to show them how it

came about, and that was the truly scientific attitude. With regard to the calcium content, although sufficient calcium was supplied in Mrs. Mellanby's experiment No. 15 or 16, there did not seem to be the same calcium content in this instance as in No. 17, in which cod liver oil was administered. He would like to ask whether, in the presence of Fat Soluble A, it was possible that the calcium might be utilised, while it was not utilised in the absence of Fat Soluble A, although supplied in large quantities as in No. 15 or 16—that is to say, in the absence of Fat Soluble A, they did not get the calcium content taken out and used. Of course, Mrs. Mellanby had been dealing with only just one link in a long chain—indeed, an endless chain. There were factors in play before that link and other factors after it, but he thought they must recognise that Mrs. Mellanby wished to confine herself to this one link in the chain she had been dealing with. He referred in conclusion to a paper by Dr. Eric Pritchard in the *British Medical Journal*, in which that author put forward views as to why the calcium was not found in the bones. Dr. Pritchard held that in all cases of chronic malnutrition the demand for the calcium in the blood was so great as to overcome the demand of the bones and teeth ; for the bones and teeth none was left.

Mr. H. T. Pitts said that he had listened with very great pleasure to this really important paper. The question was how far they were entitled to make deductions from the dogs which figured in Mrs. Mellanby's experiments and apply them to the human being. How far could they conclude that similar results might be responsible for hypoplasia and crowding of the jaws in the human ? He had seen a large number of children at a big hospital where he had charge—he supposed he had seen ten thousand of all ages up to twelve—and although, of course, he had not kept full notes, the thing which struck him was that in the majority of the children the deciduous teeth came very well formed. It was true that there was very rapid decay, so that it was quite common to find children of four or five with all the teeth carious, but the great majority were well-formed. Of course, it was quite possible to have hard and soft teeth and, apart from certain habits of using the jaw and the effect of thumb-sucking and the like, irregularities of the deciduous teeth did occur but, relatively to the total number of children, they did not seem to be very common. With regard to the question of deficient structure, hypoplasia was met with frequently but, again relatively, it was not very common. He had collected notes of about fifty cases of hypoplasia of the deciduous teeth. The subject had always been rather ignored so he was particularly interested in noting these cases. This work of which he was speaking had been done before the war and he had not hazarded any idea as to the causes, except that the condition might be associated with something which occurred during digestion ; but, reading the work of Dr. Mellanby and others, it struck him that what Mrs. Mellanby had advanced that evening might be possibly a cause. He had questioned mothers with the object of discovering whether during pregnancy there was likely to have been any deficiency in vitamines. This was obviously an extremely difficult investigation for there were few women who could give any data as to the food they had had during a period four or five years previously. But from such facts as he had collected it seemed to him that there was a deficiency, the food or the nutrition generally being of a lower order during that time in the case of the mothers of these affected children. If it were possible to carry out such an investigation in a more systematised form, some figures might be elicited which would support Mrs. Mellanby's conclusions, and would show that hypoplasia of the deciduous teeth was due to this cause. If this was the case they might expect to find the condition greatly increased among the children born during recent years, seeing that owing to a shortage of certain foods there must have been impaired nutrition. It might be worth while, through the War Office, to get in touch with those

dentists who were on duty with the army of occupation in Germany, and have them note the cases of hypoplasia that they saw in the German population, and check the number, if possible, with that of pre-war times. With regard to the figures relating to the calcium content of the teeth, he wondered whether Mrs. Mellanby had allowed enough for variations in size of the teeth occurring within the limits of the normal.

Mr. H. C. Highton said that most of the results in Mrs. Mellanby's experiments had been brought about very rapidly, in the course of a few weeks ; and, moreover, they were cases of dogs which had been starved from the beginning. Dentists, on the other hand, had to deal with children who had not been starved. Had Mrs. Mellanby any information relating to dogs which had not been starved so rapidly, and what were the res ults in regard to calcium content and bone formation in these casesy?

Mrs. Mellanby, replaing on the discussion, said that she could not pretend to reply in detail to all the questions which had been raised. She would like, however, to say that physiologists were not quite as ignorant and bigoted asl Dr. Sim Wallace took them to be. She had never considered dətnn caries as a condition starting from the inside of the teeth and had ever stated as a scientifically proved fact that dental caries was the result of a deficiency of Fat Soluble A. She had only suggested that apart from the structure there was a possible connection between the two and that immunity from caries might be enhanced by Fat Soluble A in an indirect way *via* the saliva, or by something produced in the tissues and passed into the mouth which prevented the bacteria acting on the carbohydrates.

There were many statements in the course of the discussion that she would have liked to answer had there been time ; there were others she did not wish to consider. With regard to keeping animals on a deficient diet for a longer period, that was what she was anxious to do but her audience would understand that this work was very expensive. The food material costs a considerable sum and the accommodation at her disposal was limited and therefore, unfortunately, quite a number of the dogs on which she wanted to continue the experiments had had to be sacrificed. Two of them she was now hoping to keep. For this and other reasons it was necessary to make the diets very deficient in Fat Soluble A so as to get rapid results, therefore most of the specimens exhibited showed conditions more exaggerated than were found commonly in the human being. In the human being one did not anticipate a condition in which no Fat Soluble A was received ; it might be deficient, but it could hardly be absent, whereas, in some of the diets which were used in her experiments Fat Soluble A was practically absent. She had shown these results to many doctors and to some dentists and was told that, even so, quite a number of the hypoplastic teeth met with were similar in appearance to those seen in some of her own experiments.

Considering next the calcium content of the teeth. The great difference between normal and hypoplastic teeth was seen when the weight of the teeth and their *total* calcium content were compared with their size, for in the hypoplastic teeth the relative thickness of the enamel and dentine was much reduced. The organic matter in the calcified parts, though slightly greater in proportion, was still very small compared with the inorganic material. The percentage of calcium, therefore, in a given weight of the two types was practically the same. Undoubtedly the enamel, in the very bad cases, was much softer than normal, due possibly to the imperfect calcification of the interprismatic substance.

Professor Keith had spoken about the hardening of the jaws in the course of time. In this connection she mentioned an experiment on a dog which was killed six weeks after the diet was changed from one containing linseed oil to one containing cod liver oil, and Professor

Shattock, who had kindly examined many of her experiments, considered there was little doubt from the histological appearance that the osteoid tissue was being eaten away and replaced by true bone.

With regard to statistics dealing with the diets and the relative condition of the teeth of the rich and poor, the question was bound to be a very difficult one, but there was not much doubt that in the large cities the poor did not get much Fat Soluble A. She had tried to learn from dental literature whether dentists as a whole thought there was more caries among the poor than among the rich, and her impression was that caries was certainly prevalent among the *urban* poor. She knew as a fact that, before the war at any rate, large quantities of skimmed milk was sold to the poor in many towns. She agreed that it is very important to collect statistics of observations made on human beings, but she felt it was incumbent upon those using them to be careful in the deductions they drew from them because of the multiplicity of factors usually involved. As Mr. Spokes had pointed out, she had been trying only to bring before the Society scientific facts, and, if she had drawn a few conclusions, she was careful to say that she did not place over-much reliance upon them. In the case of human material, even so far as hypoplasia was concerned, it was difficult to base conclusions on outside observations simply by looking at the mouth. In many cases, she imagined, it was not possible on examining the teeth superficially to state positively whether there was hypoplasia or not. Before this could be done, the teeth would have to be extracted and examined histologically.

Mr. S. P. Spokes asked whether Mrs. Mellanby did not consider that in the presence of Fat Soluble A more calcium was utilised.

Mrs. Mellanby replied that this was certainly so. In the absence of Fat Soluble A the calcium was not utilised to the full extent although the diet might contain large quantities in a suitable form for absorption. Of course with both deficient the condition would probably be still more exaggerated.

The proceedings concluded after a vote of thanks had been accorded to Mrs. Mellanby by acclamation.

ANNUAL GENERAL MEETING.

THE Annual General Meeting for the year 1919 was held at 11, Chandos Street, on Wednesday, December 10th, 1919.

The minutes of the last meeting were read and confirmed.

No private nominations having been received, the following gentlemen, nominated by the Council, were duly elected as Officers and Councillors :—

OFFICERS AND COUNCILLORS FOR 1920.

President	Mr. G. G. CAMPION.
Immediate Past President	Mr. J. E. SPILLER.
Vice-Presidents	Mr. J. LEWIN PAYNE.
	Mr. W. W. JAMES.
	Mr. P. SIDNEY SPOKES.
Secretary	Mr. HAROLD CHAPMAN.
Treasurer	Mr. H. C. HIGHTON.
Curator and Librarian	Mr. B. MAXWELL STEPHENS.
Editor	Mr. CARL SCHELLING.
Councillors	Mr. HEDLEY C. VISICK.
	Mr. A. H. CLOGG.
	Mr. SHELDON FRIEL.

AUDITORS.

On the motion of Mr. Northcroft, seconded by Mr. Spokes, Mr. Bertram B. Samuel and Mr. Arthur Colyer were appointed Auditors.

CANDIDATES FOR ELECTION.

Mr. G. E. McMahon, L.D.S.Eng., D.D.S.Penn., and Mr. E. Spencer Tebbutt, L.D.S.Eng., D.D.S.Penn., were elected members of the Society.

HONORARY TREASURER'S REPORT.

The HON. TREASURER reported :

THE BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS.

STATEMENT OF ACCOUNTS from December 1st, 1918, to November 30th, 1919.

1917-1918. £ s. d.	RECEIPTS.	1918-1919. £ s. d.
	To Balances brought from last account :—	
167 16 11	Cash at Bank	163 16 7
5 16 0	Interest on Exchequer Bonds ...	5 12 0
0 15 1½	Cash in hand	0 11 3½
66 3 0	Subscriptions received during the year...	60 18 0
£240 11 0½		£230 17 10½

1917-1918. £ s. d.	PAYMENTS.		1918-1919. £ s. d.
7 7 0	By Rent		7 7 0
1 6 0	Printing and Stationery...		2 17 9
1 7 2	Postage, 'Phone and Sundry Expenses		2 6 10
£10 0 2			£12 11 7
66 3 0	Subscriptions Remitted		60 18 0
£76 3 2			73 9 7
	Balances carried to next account :—		
150 0 0	Exchequer Bonds		150 0 0
13 16 7	Cash at Bank...		6 5 6
	Cash in hand :—		
0 11 3½	Hon. Secretary ...	0 9 11½	
	Hon. Treasurer	0 12 10	
			1 2 9½
£240 11 0½			£230 17 10½

We have examined the Books and Vouchers and certify the above Statement of Accounts to be correct.

(Signed) CHAS. J. BLAABERG,
H. D. SHORE,
Hon. Auditors.

Curator and Librarian's Report.

The Curator and Librarian reported that at present the Library was in a condition of stasis, but he hoped that would soon be altered. He was particularly anxious to receive suggestions with reference to any books which the members considered should be added to the Library.

Hon. Secretary's Report.

My first duty in making this report is to announce that the Society reverted to its previous activities by holding its first Ordinary Meeting since March 1st, 1916, on October 8th last.

Before passing to the business portion of my report I have to announce that sixteen members served in the Great War and that two members, Messrs. R. H. Heath and J. Scobie made the supreme sacrifice. Our profound sympathies go out to the bereaved of the latter and the former we are glad to have amongst us once again. The following are the members who also served :—

Mr. H. P. Aubrey, 40, Curzon Street, Mayfair, W.
Mr. Leslie G. Austen, Cambridge House, Portsmouth.
Mr. Ralph Chapman, 151, Finchley Road, N.W.3.
Mr. J. W. Doherty, Stranraer, Bernard Gardens, Wimbledon.
Sir F. M. Farmer, St. Winifred's, Hampton, Middlesex.
Mr. J. G. Fernie, Holmleigh, Murray Road, Northwood, Middlesex.
Mr. Arthur W. Johnson, 71, Grosvenor Street, W.
Mr. Gordon Johnson, 46, Lee Terrace, Blackheath, S.E.
Mr. H. C. Malleson, 30, Thurlow Road, Hampstead, N.W.
Mr. H. E. Marsh, 1, Cantelupe Road, Bexhill, Sussex.
Mr. J. W. Mayer, Stedham House, Surbiton Hill.
Mr. Bertram Samuel, 76, Wimpole Street, W.1.
Mr. B. Maxwell Stephens, 76, Grosvenor Street, Grosvenor Sq., W.
Mr. W. S. Stranach, 18, Stratford Place, W.
Mr. Hedley Visick, The Wolds, College Road, Eastbourne.
Mr. Ernest White, 40, Park Square, Leeds.

The meeting on October 8th made a reputation for itself by occurring immediately after the railway strike. This, however, did not prevent Mr. Friel from coming from Dublin to read his valuable paper on the Lingual Arch, though undoubtedly it affected the attendance at the meeting.

The second Ordinary Meeting was held on November 18th, when Mrs. Mellanby honoured the Society by reading an important paper dealing with the effect of diet on the growth of the jaws from the experimental point of view. Many members and visitors were present on that occasion.

Such a paper as Mrs. Mellanby's brings back memories of the contribution Prof. Arthur Keith made to the Society on the 8th October, 1913, and emphasises still further the intricacies of the etiology of irregularities of the teeth, and perhaps this evening we may have glimpses of the same problem from yet another point of view.

This evening the practice of having a paper in conjunction with the Annual General Meeting has been continued, and it is the Society's good fortune to have Mr. J. F. Colyer here again. It is exactly four years since he read his previous paper to the Society.

The Council has not been inactive since it was restored to the Active List. Though it has no record of completed work to report, it has under consideration the following :—

1. The offering of prizes in orthodontics to Dental Schools, and a reduction of the subscription for a period after qualification.
2. The change of rendezvous to 23, Russell Square, W.C.1, the new home of the British Dental Association.
3. The position of Casual Communications on the agenda after the paper of the evening.

It will be noticed from the list of nominations that the offices of Curator and Librarian have been combined, and that Mr. Maxwell Stephens, who has carried out the duties of both offices for some time, has been nominated for this post.

The membership of the Society is now ninety-five ordinary and corresponding members and one honorary member, including those to be elected this evening. In addition, the Council has this evening approved three candidates for election at the January meeting.

HAROLD CHAPMAN, Hon. Secretary.

December 10th, 1919.

On the motion of Mr. VISICK, seconded by Mr. RUSHTON, the above reports were received and adopted.

RETIRING PRESIDENT'S VALEDICTORY ADDRESS.

It is now four years since I was invited to occupy this chair, and these years have been, perhaps, the most vital in history. Happily, the Great War has been brought, as we hope, to a successful termination, and we are now free to resume the work of this Society. The period since 1915 has been for us, as a Society, almost entirely one of rest, although individually members have given unstinted service to the common cause. It has been a time when it was felt, and I believe rightly felt, that things of greater importance should occupy our attention, but now we hopefully anticipate that the Society's resting period may be followed by one of growth and a rich harvest in the future. There is already evidence of this in the excellent papers which we have been privileged to hear during the present session, and I am confident that you will all wish me to make especial mention of the one by Mrs. Mellanby, which opens up new avenues of research of the greatest importance and interest to us as students of orthodontics. At the inaugural meeting of the Society our President, Mr. J. H. Badcock, very wisely laid emphasis on the point that we met as students. That, I think, was eleven years ago, and as one who is still content to remain a student, I feel that I have learned, and am still learning, at least one thing, and that is the limitation of our knowledge regarding the etiology of the cases we are called upon to treat. Scientific treatment must be based on correct diagnosis, embracing a knowledge of etiological causes. In practice I believe that we frequently learn less from our successful cases than from our failures, which (apart from accidental causes) are usually the result of an imperfect understanding of the etiology of our cases. I would therefore seriously suggest that a meeting at some time might be devoted to the discussion of unsuccessful cases, and I am not certain that the meeting would not have a record success.

In conclusion, I must thank you most sincerely for the generous support you have accorded to me. And I am sure that I am expressing your unanimous sentiments as well as my own when I say how much the Society owes to its excellent officers, and in particular to our Secretary, Mr. Harold Chapman. The present condition of prosperity of the Society is very greatly due to his untiring services. My remaining and most pleasing duty is to ask Mr. Campion to take the chair, and to tell him how fortunate we consider ourselves in that he has consented to be our President.

Mr. CAMPION then took the Presidential Chair amidst applause.

The PRESIDENT (Mr. Campion) thanked the Members sincerely for the great honour they had done him in electing him to the office of President. Some years ago the Council had invited him to allow himself to be nominated for the office, but at that time he had been suffering from what was now popularly known as shell-shock. The war, however, seemed to have blasted him into renewed health and vigour, and he looked forward with the greatest possible pleasure to meeting the members periodically during the next twelve months and profiting very greatly by their papers and discussions.

Mr. RUSHTON then proposed a very hearty vote of thanks to Mr. Spiller for his conduct in the Chair during his term of office as President. Mr. Spiller had not been overworked in the Chair, but had done very useful work elsewhere, and he, Mr. Rushton, was quite certain that if Mr. Spiller had had as busy a session as it was hoped the coming session would be, that he would have conducted himself in the way the members always expected of him.

Mr. VISICK seconded the resolution, which was carried with acclamation, Mr. Spiller briefly acknowledging the vote.

The following paper was then read :

A Note on the Growth of the Dental Arch.

By Sir FRANK COLYER.

The growth of the jaws from birth onwards is thus described by Hunter : " The jaw still increases in all points till twelve months after birth, when the bodies of all the six teeth are pretty well formed ; but it never after increases in length between the symphysis and the sixth tooth ; and from this time, too, the alveolar process, which makes the anterior part of the arches of both jaws, never becomes a section of a larger circle, whence the lower part of a child's face is flatter, or not so projecting forwards as in the adult.

" After this time, the jaws lengthen only their posterior ends ; so that the sixth tooth, which was under the coronoid process in the lower jaw, and in the tubercle of the upper jaw of the fœtus, is at last, viz., in the eighth or ninth year, placed before these parts ; and then the seventh tooth appears in the place which the sixth occupied, with respect to the coronoid process, and tubercle ; and about the twelfth or fourteenth year, the eighth tooth is situated where the seventh tooth was placed. At the age of eighteen or twenty, the eighth tooth is found before the coronoid process in the lower jaw, and under, or somewhat before the tubercle in the upper jaw, which tubercle is no more than a succession of sockets for the teeth till they are completely formed."

John Tomes, who devoted a considerable amount of attention to the growth of the jaws, arrived at much the same conclusion, and a similar view is held by C. Tomes.* The latter author gives a diagram of the mandible of a nine months' fœtus superimposed upon that of an adult and remarks† that " It will be seen that the arch of the jaw in the fœtus is as wide and as large as in the adult," but in his " Dental Anatomy " (p. 233) he remarks, " In point of fact, contemporaneously with the development of the crypts of the permanent teeth inside them, the deciduous teeth and their outer alveolar plate are pushed outwards." He therefore seems to recognise that an increase in the size of the arch does take place, although he clearly considers that this increase is but slight, for in his " Dental Surgery " (p. 59) he remarks, " With the trifling exception already alluded to, the twenty anterior permanent teeth occupy an arch but little different in size or shape from that occupied by the twenty deciduous teeth."

* See " A Manual of Dental Anatomy," 7th edition. Chapter on " The Development of the Jaws."

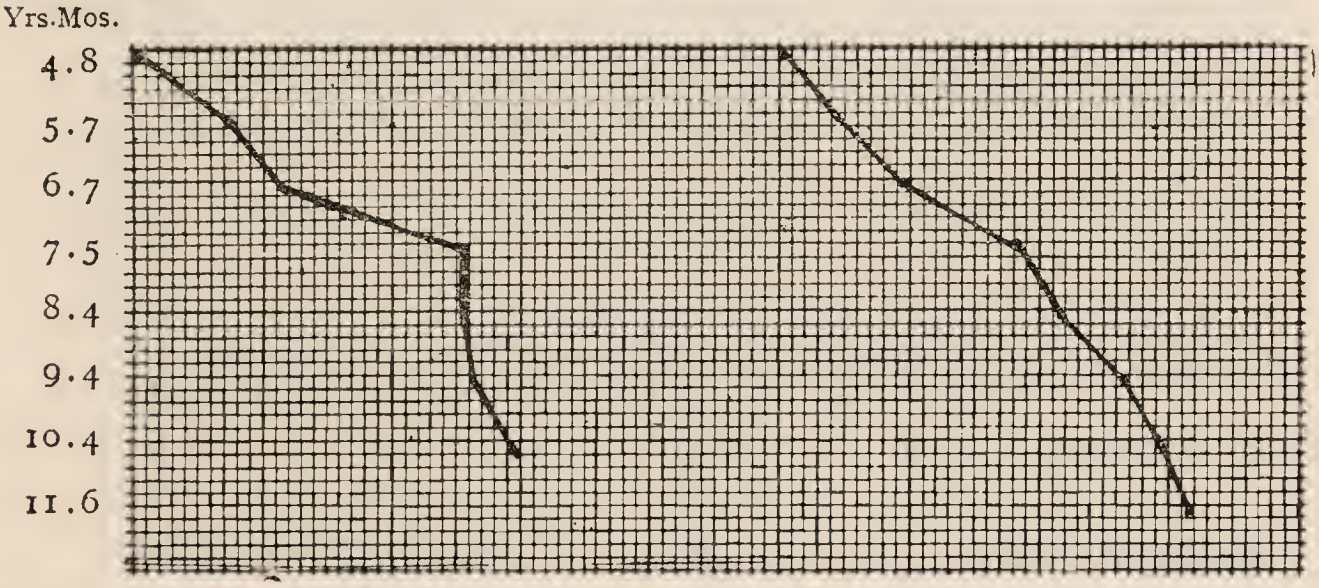
† " A System of Dental Surgery," 5th edition, p. 7.

My clinical experience does not entirely coincide with this view and with the object of investigating the question, I have taken models of three children at fairly regular intervals from the age of three years onwards and it is to the facts disclosed by that series that attention will be drawn.

These children will be designated E., B., N. ; the first and second are girls, the third a boy. All three were breast-fed ; they have not suffered from the slightest trace of nasal obstruction or required any operative treatment for " tonsils and adenoids " and, but for the usual children's illnesses, i.e., measles and chickenpox, they have never had any set-back to their growth.

Measurements have been taken between the canines and the deciduous second molars, with an apparatus by means of which tenths of a millimetre could be registered.

In using plaster models for measurements errors are likely to occur ; first, there is the difficulty of always measuring at the identical part ; second the possibility of alteration in the plaster casts ; and thirdly the difficulty—a real one in the case of children —of always obtaining good models—a " drag " may occur at the point required for measurement. These sources of errors prevent absolutely correct measurements, but even with these disadvantages, the figures obtained are sufficiently correct to demonstrate certain facts in the alteration of the dental arch during childhood.



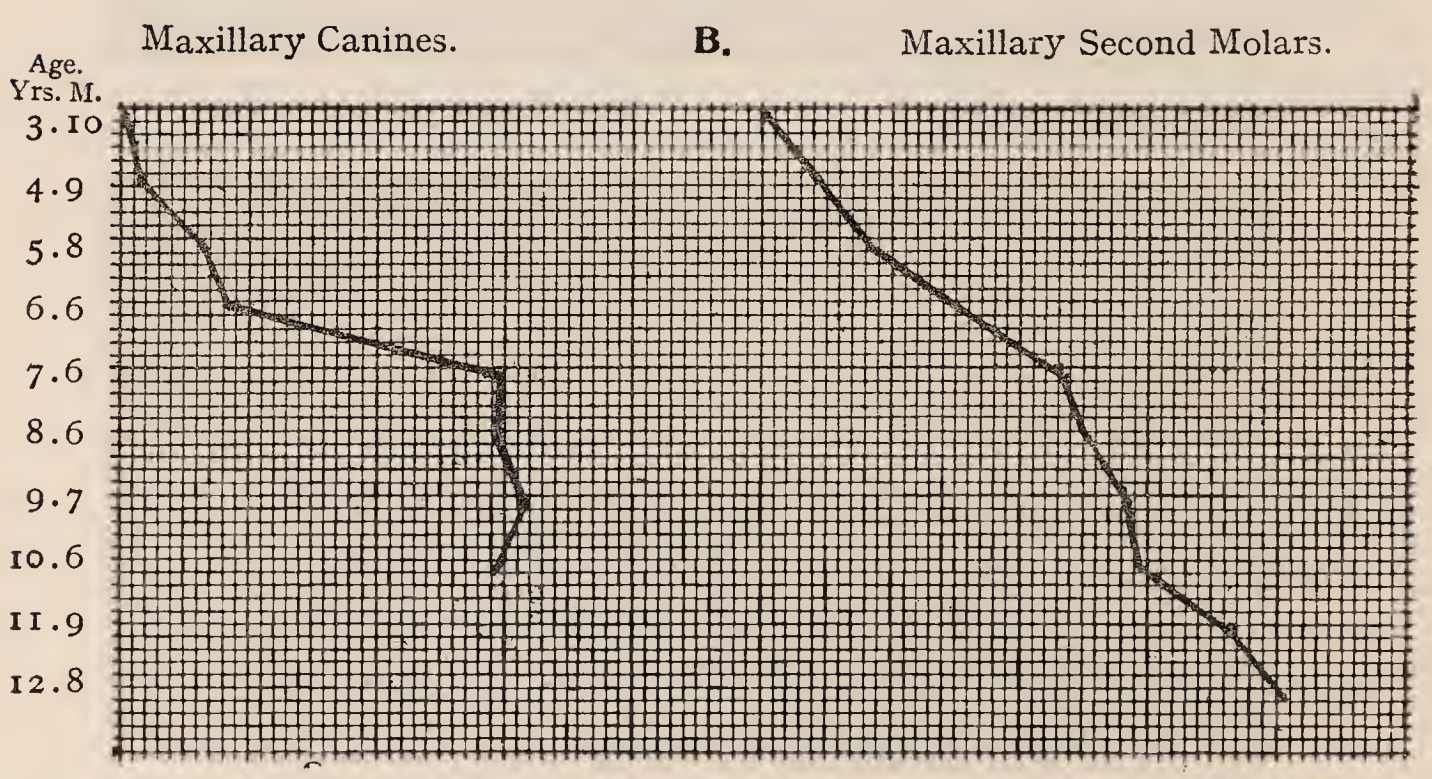
The measurements of the children E., B., N. are as follows :

E.

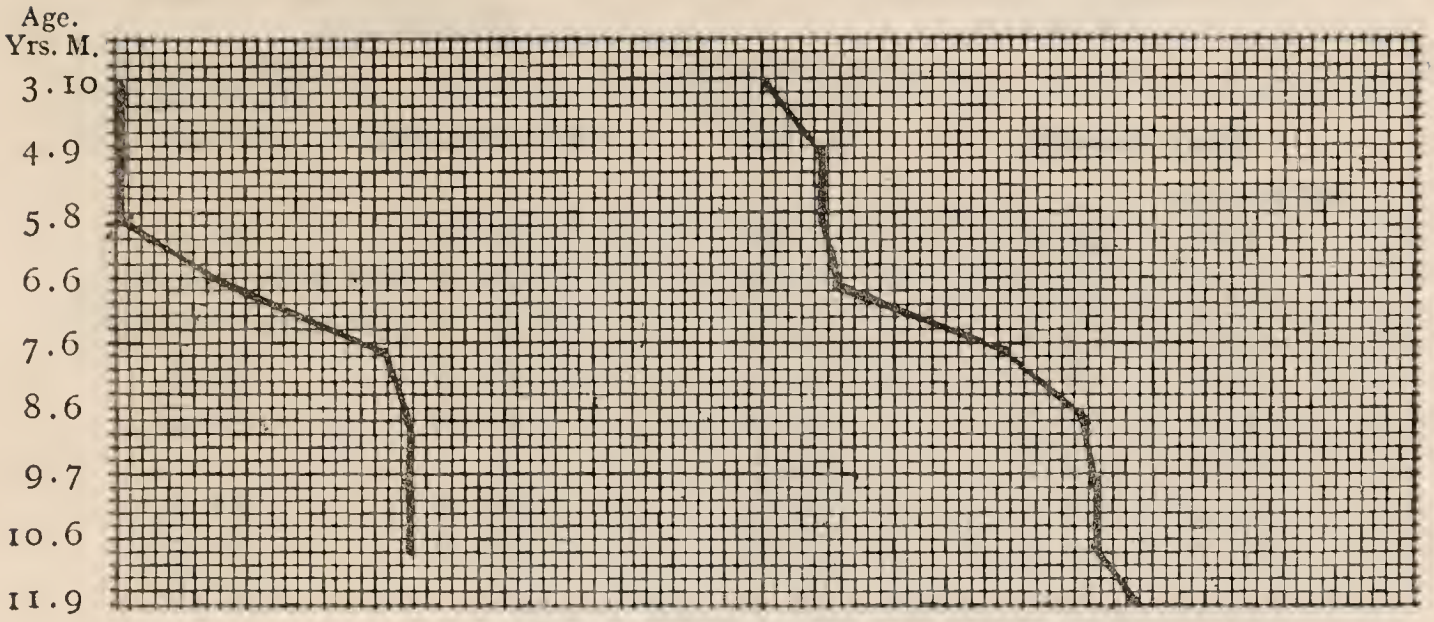
	Maxilla.		Mandible.	
Age yrs. mos.	Inter-canines	Inter-second deciduous molars.	Inter-canines	Inter-second deciduous molars.
4.8	22.5	26.4	17.4	25.5
5.7	23.2	26.8	17.6	25.6
6.7	23.6	27.3	18.2	26.3
7.5	25.0	28.2	19.6	27.1
8.4	25.0	28.5	19.7	27.5
9.4	25.1	29.0		27.6
10.4	25.4	29.3		28.3
11.6		29.5		28.0
Total increase	2.9	3.1	2.3	2.5

B.

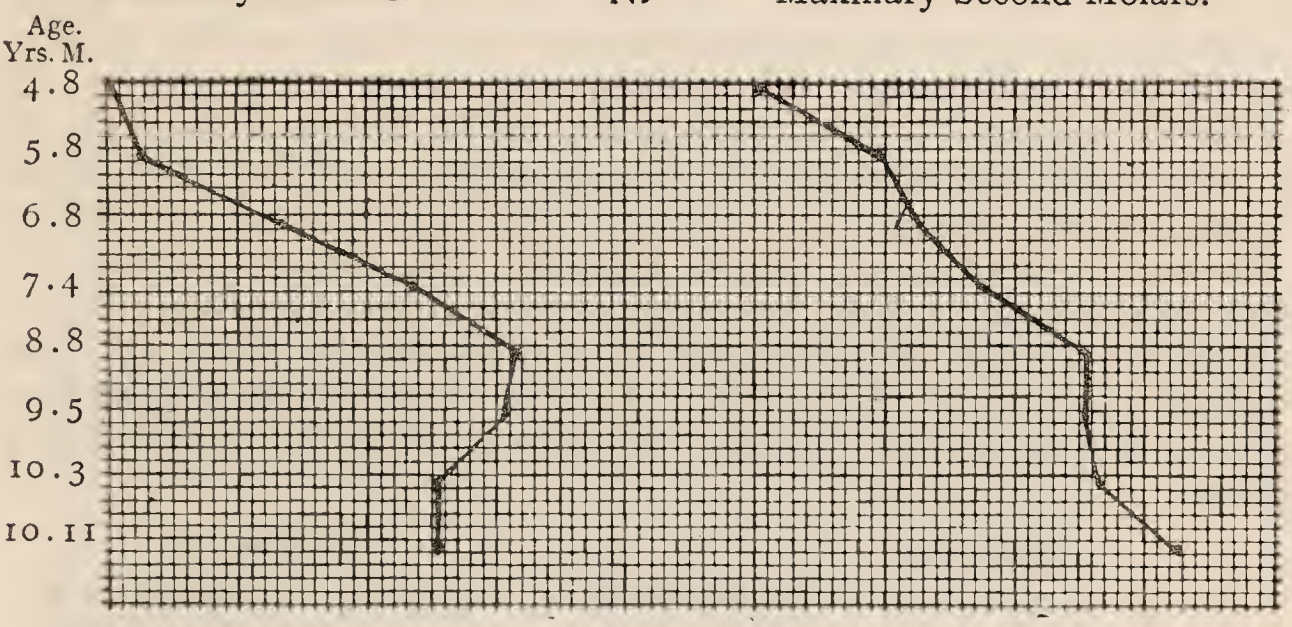
	Maxilla.		Mandible.	
Age yrs. mos.	Inter-canines.	Inter-second deciduous molars.	Inter-canines.	Inter-second deciduous molars.
3.10	23.6	28.7	19.3	27.8
4.9	23.7	29.1	19.3	28.2
5.8	24.2	29.5	19.3	28.2
6.6	24.4	30.2	20.1	28.3
7.6	26.5	31.0	21.3	29.6
8.6	26.5	31.2	21.5	30.2
9.7	26.7	31.5	21.5	30.3
10.6	26.5	31.6	21.5	30.3
11.9		32.3		30.6
12.8		32.7		
Total increase	2.9	4.0	2.2	2.8



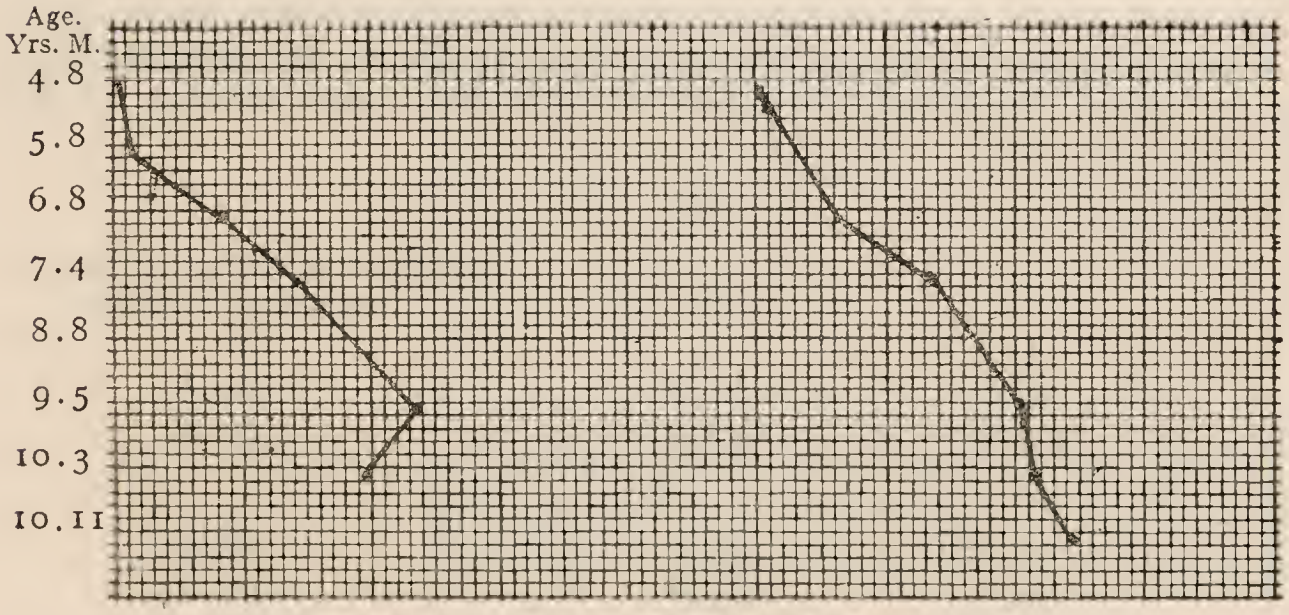
Mandibular Canines. **B.** Mandibular Second Molars.



Maxillary Canines. **N.** Maxillary Second Molars.



Mandibular Canines. Mandibular Second Molars.



N.

Age yrs. mos.	Maxilla. Inter-canines.	Maxilla. Inter-second deciduous molars.	Mandible. Inter-canines.	Mandible. Inter-second deciduous molars.
4.8	25.0	30.0	20.1	29.2
5.8	25.2	30.9	20.2	not ascertainable
5.8	25.2	30.9	20.2	not ascertainable
6.8	26.3	31.2	20.9	29.8
7.4	27.3	31.7	21.5	30.5
8.8	28.1	32.5		
9.5	28.0	32.5	22.4	31.2
10.3	27.5	32.6	22.0	31.3
10.11	27.5	33.2		31.6
Total increase	2.5	3.2	1.9	2.4

In the diagrams given, an endeavour has been made to show this increase in growth in a graphic manner on millimetre paper and for this purpose ten millimetres have been taken as the equivalent of one millimetre. These diagrams show very clearly (1) the rapid increase in the inter-canine width between the ages of six and eight years, a period corresponding to the eruption of the permanent incisors; (2) the more regular increase in the width between the deciduous second molars. The slight decrease in width which may follow the maximum increase is probably due to a slight inward displacement of the deciduous teeth by their erupting permanent successors. If this decrease is disregarded and only the maximum increase considered, we obtain the following figures:

	Maxilla. Inter-canines.	Maxilla. Inter-second deciduous molars.	Mandible. Inter-canines.	Mandible. Inter-second deciduous molars.
E.	2.9	3.1	2.3	2.8
B.	3.1	4.0	2.2	2.8
N.	3.1	3.2	2.3	2.4

To ascertain the difference in the arches formed by the deciduous teeth and their permanent successors, measurements were taken across the outer aspects of the maxillary teeth at the gum margin; for practical purposes these points gave the outer margin of the alveolar process.

The figures are:—

E.

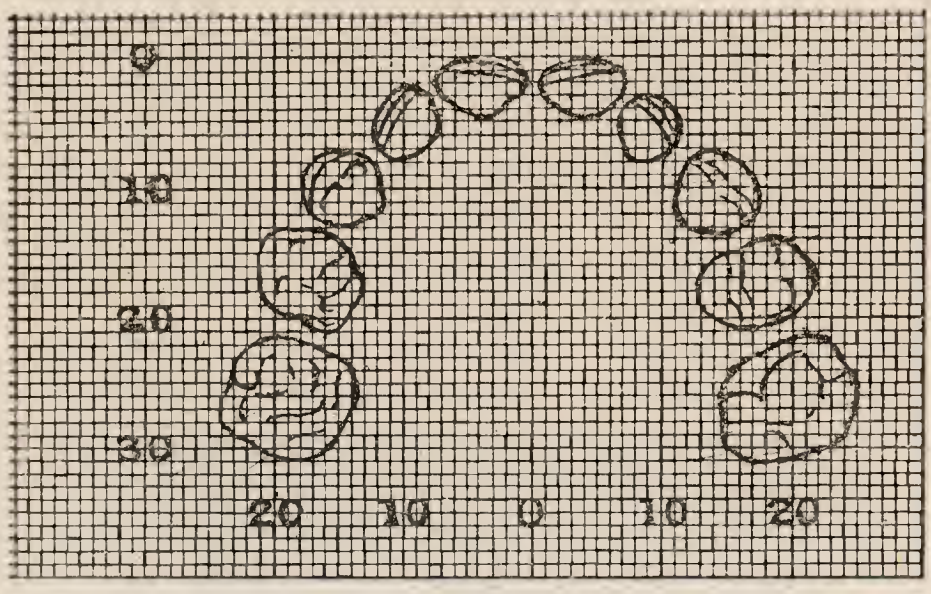
Age.	Canines.	Deciduous second molars or second pre-molars.
4.8	32.7	44.5
14.6	37.5	47.0

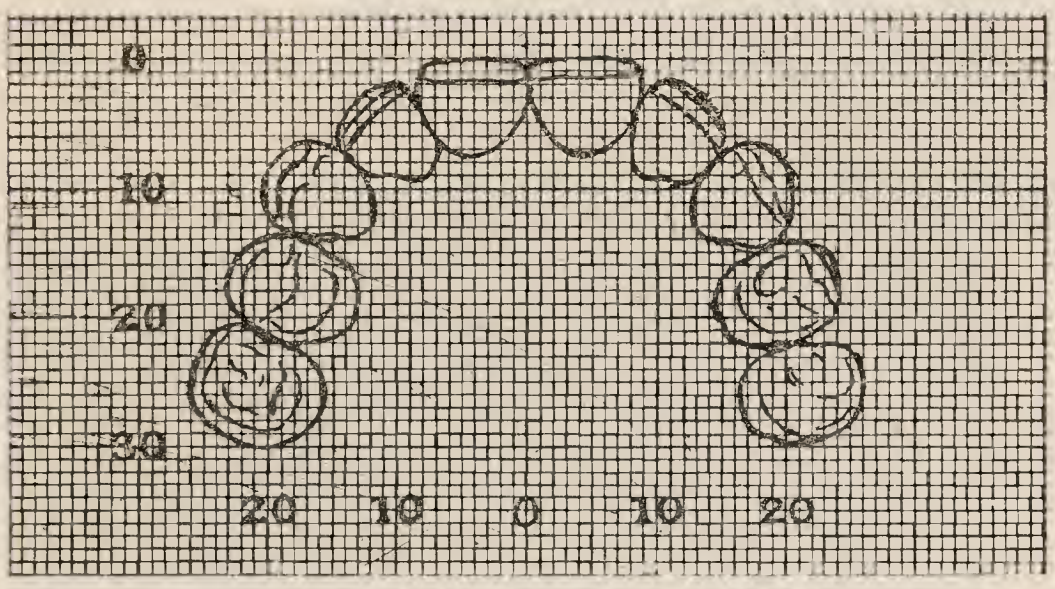
B.

3.10	35.7	48.0
15.5	41.7	52.1

Mr. W. Finerty has very kindly drawn the arches formed by the two dentitions on millimetre paper. It is difficult to draw exactly to scale but the diagrams are accurate enough to show the difference in the shapes of the arches of the deciduous and the permanent teeth.

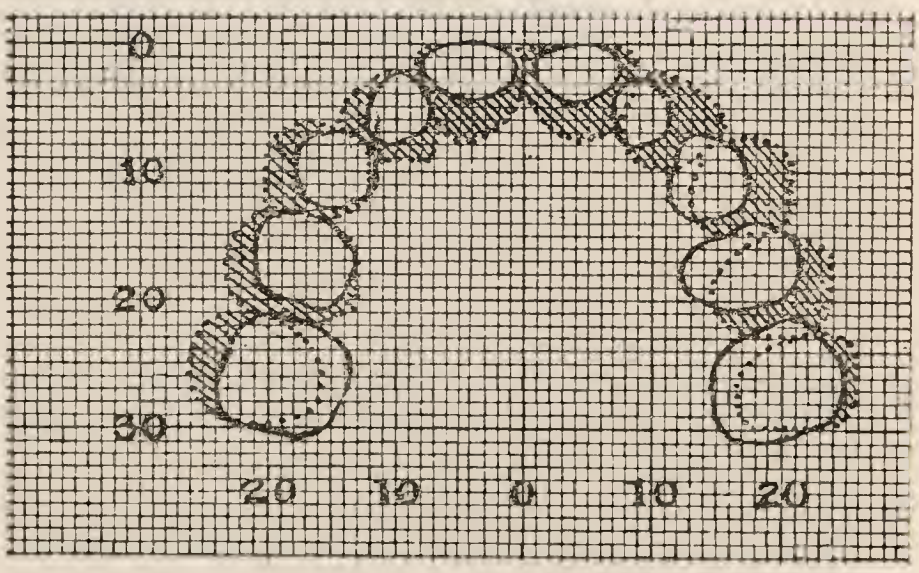
A





B

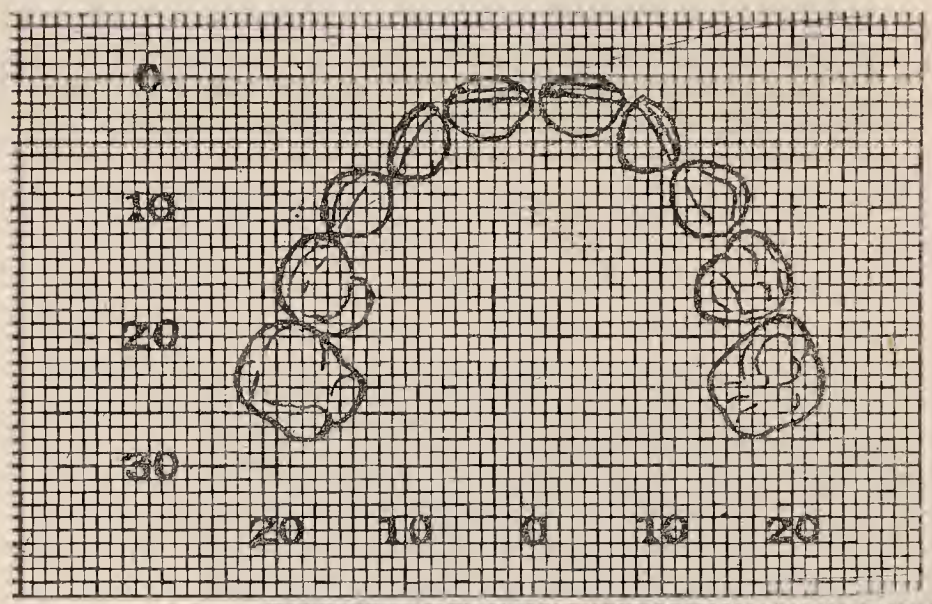
A
and
B



We may now turn to the series in the Royal College of Surgeons which formed the subject of the paper by C. S. Tomes. The measurements of these models are as follows:

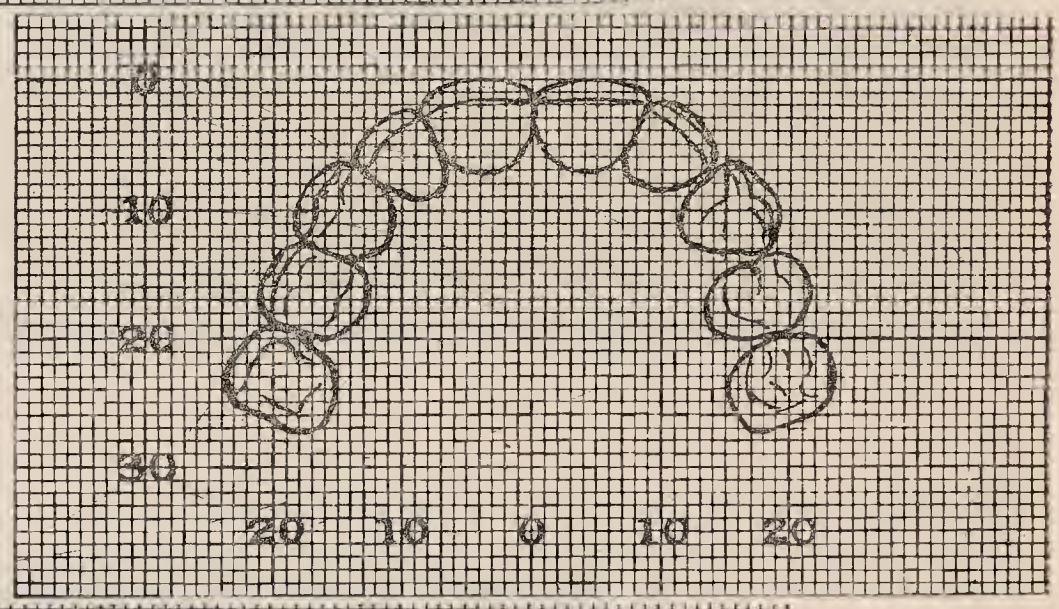
MAXILLA.

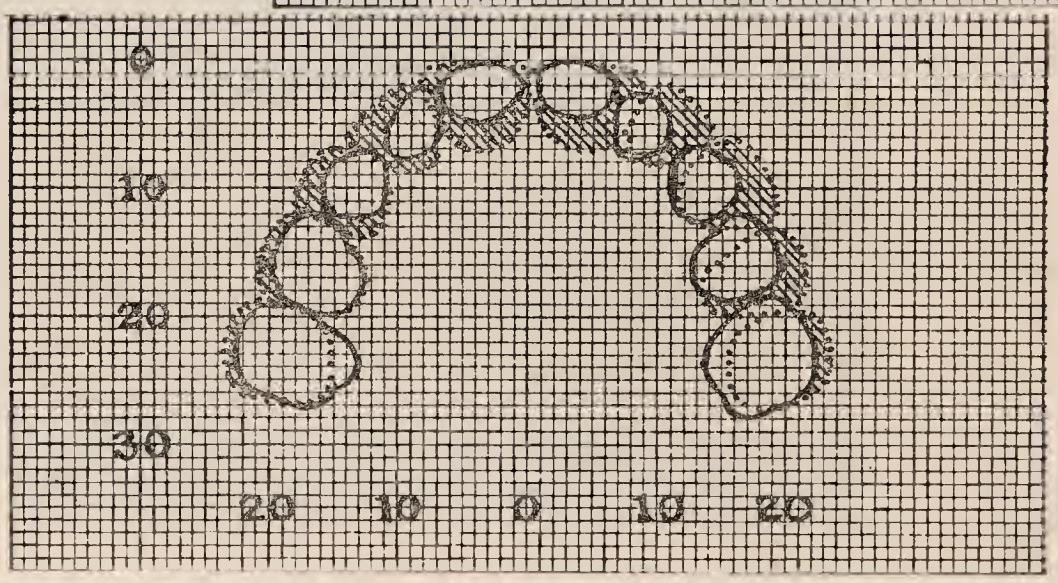
Age.	Inter-canines.	Inter-deciduous second molars.
4	20.0	26.6
5	20.0	27.0
6	20.2	27.2
7	20.5	27.4
8	21.0	28.0
9	22.8	29.3
10	23.0	29.5
11	23.0	29.7



C

D





C and D

The maximum increases between the canines and deciduous second molars are 3.0 and 3.1 mm. respectively. These increases are almost identical with the average increases in E., B., and N. The principal increase in the inter-canine width occurred at a later date than in the other three children and this is of interest because the eruption of the incisors was delayed. The deciduous teeth in this child were close together, the width between the canines and deciduous second molars being 20.2 mm. and 26.6 mm. compared to 23.7 mm. and 28.3 mm., the average of E., B., and N. In this child the permanent teeth assumed a crowded condition; unfortunately there is no history available, so that one is unable to state whether this crowding was associated with "adenoids."

In the four children we have definite increase in the width of the arch between the ages of four to eleven years. In three, the permanent teeth form normal arches, in one, an abnormal arch. The three children with normal arches start with well-marked spaces between the deciduous teeth; the child with an abnormal arch with the deciduous teeth close together, a condition which suggests an interference with growth during the first four years of life.

The conclusion to be drawn from the series of models described is that in the normal growing child the permanent incisors, canines and pre-molars assume a distinctly larger arch than that occupied by the deciduous teeth. The way in which this change is brought about is not clear. I do not think it can be attributed to a forward pressure exerted by the developing teeth, because the permanent canine lies above the deciduous canine, and slightly external to the arch, and the pre-molars are embraced by the roots of their deciduous predecessors. In the first years of life there is reason to think that in the region of the canine it may be due to growth of the suture between the pre-maxilla and maxilla. It is stated that this suture closes soon after birth, but in a former paper* it was shown that in many specimens the suture is well defined until, in some cases, the age of seven years. An examination of the specimens showed (1) that there is a distinct increase in the size of the pre-maxilla of the child of six years compared with that of the infant of six months; (2) that the sutures are as a rule well developed in the specimens showing well developed arches and spacing of the teeth; (3) that where the suture is ill-defined the teeth are often close together or slightly crowded.

There is a difficulty in drawing definite conclusions from dried specimens; in the first place, the cause of death is usually not known, and the probability is that in the majority of cases the children were not examples of normal growth; still further, there is the fact of the wide variation in widths of arches, and the number of specimens available is insufficient to allow a satisfactory average to be obtained of each age period. But taking into account these difficulties, the general impression, after examining the specimens, is that a definite relationship does exist between the early closure of the suture and the width of the arch in the region of the canine.

In the children E. and B., the permanent canines erupted before

* *Dental Record.*

the second pre-molars and came down into a correct position in the arch and with the eruption of both pre-molars there were spaces between the teeth, this being especially marked in the case of E. These spaces have tended to close but the closing has been brought about, not by the backward movement of the canines, but by the forward movement of the first molars; this has been ascertained by taking measurements between the antero-internal angle of the first molar and a point midway between the central incisors.

Many more observations are necessary before we can say definitely that an increase in the dental arch occurs in all cases. If it does, then it is quite clear that the fact must be taken into consideration in deciding upon the treatment to be pursued in cases of crowding of the teeth seen at an early age of life.

The PRESIDENT, in opening the discussion, said Sir Frank had presented an exceedingly interesting paper. Personally he found it rather difficult to discuss, because he had to accept all Sir Frank's conclusions practically as proven; but he had no doubt that several members would like to discuss them. The only point on which he in any way differed from Sir Frank was in regard to Sir Frank's finding against early expansion of the arch. Personally he always liked to expand fairly early, say at the age of eight years.

Dr. SIM WALLACE remarked that what Sir Frank had said agreed with a series of models which he himself had taken. He had not taken inter-canine measurements, but measurements between the temporary molars, and they showed almost exactly the same increase in width as Sir Frank's measurements. He had given the measurements before the Society about seven or eight years ago. He would like to emphasise what Sir Frank had said with regard to the early expansion of the arch. He (Dr. Sim Wallace) had shown not the models but the actual child to an American colleague, and at that particular time the permanent incisors had come into position and also one or perhaps both of the permanent molars. That had left all the temporary molars in position distinctly large—at least large as compared with the permanent pre-molars, and there had been a slight indication of crowding. His American colleague had advised him to expand the boy's arch; but he had not followed that advice, and he thought it would be seen from the models that there was no need for it. In fact, since the boy's permanent pre-molars had erupted there had been spaces between, and they were only gradually closing up now at the age of nearly nineteen, and the wisdom teeth were through, so there was no crowding at all. In fact, it would be seen that there were spaces in the permanent teeth both before and behind the canines, and although it could not be seen in the model, there were actually spaces between the temporary molars below.

There were slight spaces between the pre-molars, and it would be noticed that on both sides there were spaces on either side of the canines.

What he did desire to know was whether Sir Frank's children had been brought up on pap. The child he (Dr. Sim Wallace) had shown had not been breast-fed, but the development of the dental arch had not seemed to be in any way affected by that circumstance. He did not think any person could doubt, after the experiments by Laurence Baker, that there was a general stimulation of the development of the jaw as the result of efficient mastication. He could only say with regard to the particular child to which he had referred that in the early days the only things he had not been allowed to eat up till about two and a half years were bread sop, milk porridge, milk, and

milk puddings. Otherwise he had been allowed to eat anything he had liked.

Mr. MAYER said from the few cases which he had treated, and from the results of seeing models and the experience of other practitioners he had come to the conclusion that the best time to expand the arch was at the age of six years. After Sir Frank's lecture, he felt more convinced than ever that the best time to expand the arch was at that age. Surely if the arch was going to grow wider at about the age of six, that was the most beneficial time at which to expand it ? He did not know whether Sir Frank approved of that.

Mr. NORTHCROFT said he did consider there was one point with regard to the very vexed question of the expansion of arches at an early age which, he would not say had been overlooked by Sir Frank, but at the same time Sir Frank gave one rather a false impression in reference to what he had said, because Sir Frank had been dealing with probably as normal a series of models as one could come across. He (Mr. Northcroft) took it that any self-respecting orthodontist would not undertake, in spite of Dr. Sim Wallace's American colleague, the expansion of an arch unless there was obviously, one could not call it exactly a pathological condition, but an abnormal condition of the arch present. He quite agreed with Sir Frank ; his only observations on several models bore out exactly what Sir Frank said—that one got a normal growth in a normal child ; but if one was going to get a lack of growth in an abnormal child, surely that was where the orthodontist could step in and stimulate natural growth to take place in the abnormal child ? Then one tried to make normality replace abnormality, and it seemed to him, with all due deference, orthodontists were still doing good work for their patients. He had had several cases of the kind where he had rather flattered himself that it was his own efforts rather than those of Nature which had produced a satisfactory result, and he would be sorry after all those years of effort if he had to come to the conclusion that it had been Nature after all that had been doing the work and that he had been taking the fees !

Mr. CHAPMAN said he had been particularly struck with the point which Sir Frank had brought out, that the lower arch did not widen to the same extent as the upper arch. It had occurred to him whether that was not perhaps explained to some extent by a slight forward movement of the mandible and with it of the teeth, and as the side teeth were not on parallel lines but on lines which diverged backwards that would give what would correspond to a slight increase in the width. It also seemed to him there was probably something in Sir Frank's theory that the pounding of the lower teeth against the upper had the effect of widening the upper teeth. It was well known that an ordinary plate without any screw, if it was worn for some time, would very frequently effect an increase in the width of that arch without any apparent work on the part of the orthodontist to bring it about.

Sir FRANK COLYER, in reply, said he did not wish to be drawn into the question of the expansion of the dental arch, because he had already expressed his opinions on that matter. He considered it was founded upon a fallacy from top to bottom, but he would like to deal with that matter on another occasion. The idea that if one pressed the teeth out one stimulated growth of the jaw was nonsense. Not sufficient was known about the anatomy and physiology of the teeth, and the old teaching that the alveolar process was formed from the body of the jaw was all wrong. The tooth was an entity by itself. One got a tooth follicle growing up, and round that one got a bony covering

distinct from the jaw, and then the body of the jaw came up and enclosed it. The actual question of the size of the teeth and of the jaw were two totally different things, and he thought that comparative dental anatomy showed that pretty clearly. Mr. Northcroft might say what he liked, but the arch of the girl's models which he had shown obviously wanted expanding. She had expanded it herself in the course of three years.

Mr. NORTHCROFT : Not to the full.

Sir FRANK COLYER said that did not matter. It could not expand to the full because her jaw had not grown, but she actually had increased. The normal growth which would take place had occurred, and he did not see how by expanding the arch one was ever going to increase the growth of the maxilla, which probably depended upon other things. With regard to Dr. Sim Wallace's remarks, his (Sir Frank's) children had been brought up on plenty of bread and butter and plenty of milk puddings. They had not had a pap diet but an ordinary diet, and milk puddings unfortunately entered largely into it, and they had grown up with practically no caries. With regard to the expansion of the arch at the age of six, his point about the whole thing was that, if the jaw was going to grow normally, why step in with artificial methods ?

Mr. NORTHCROFT : What if it does not grow normally ?

Sir FRANK COLYER said that opened up the whole question of the expansion of the arch, which he would deal with on another occasion. All he desired to say was that the growth of the arch did take place in the normal and also in the abnormal. He had not had time to go through all his models, but he was certain that even in children who had adenoids a natural growth took place almost to the same extent as in a normal child. What they had to learn something about was what was interfering with the growth of the jaw up to the age of four, and if they could find out anything about that they would go a long way in dealing with the whole question of the etiology of the jaw.

Mr. CAMPION exhibited some diagrams of a similar character to those shown by Sir Frank Colyer, as he thought it would be extremely interesting to compare the two sets. He was very profoundly convinced of the importance of studying the development of the arch quantitatively in that manner, as a possible means of getting some further and better knowledge of etiology.

The first drawings, which he had been allowed by Mr. Chapman to throw on the screen, were those of models which Mr. Chapman had brought before the Society in the year 1914. The measurements would be found to be recorded in the Society's Transactions.

The first drawing Fig. (*a*) showed the arch of the temporary teeth at the age of five years giving a measurement between the second temporary molars of 31 mm., and an inter-canine measurement (the same measurement which Sir Frank Colyer had taken) of 26 mm.

The next drawing Fig. (*b*) showed the same arch four years later. The breadth between the second temporary molars had increased from 31 mm. to 34 mm., and the inter-canine measurement had increased only by 1½ mm. It was very large at five years and the increase had probably been earlier than in the cases which Sir Frank Colyer had shown.

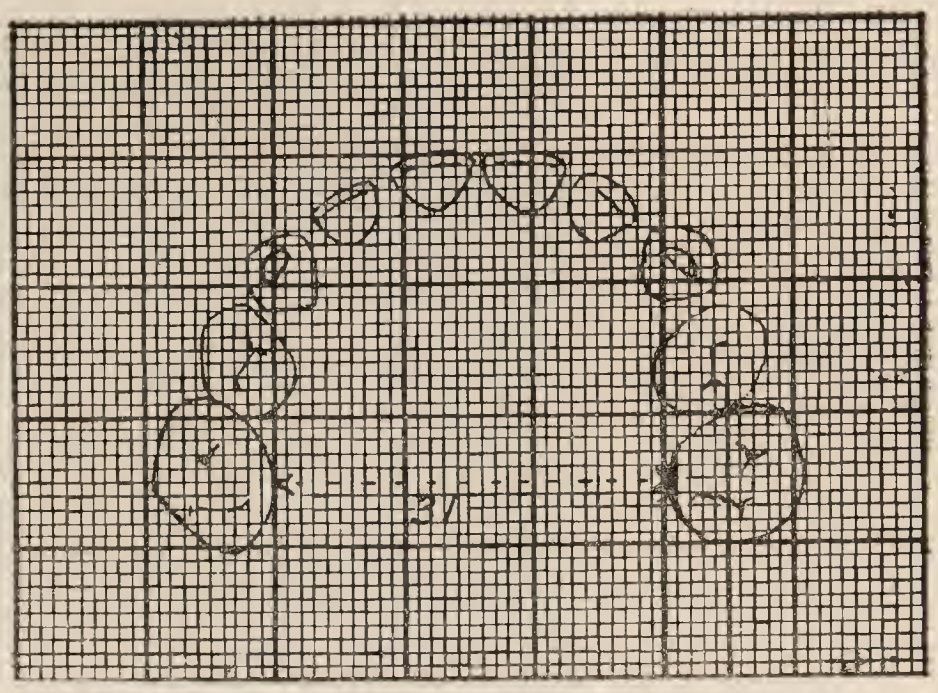


Fig. (*a*).
Mr. Chapman's case. Upper arch at $5^{Y}\,0^{M}$.

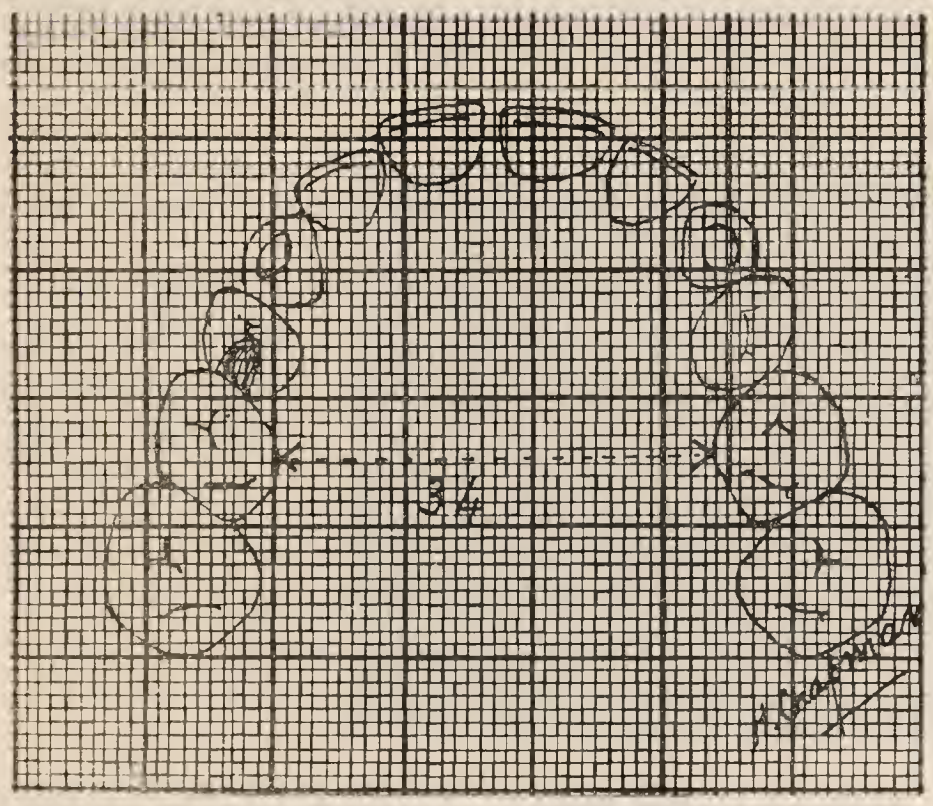


Fig. (*b*).
Mr. Chapman's case. Upper arch at $9^{Y}\,2^{M}$.

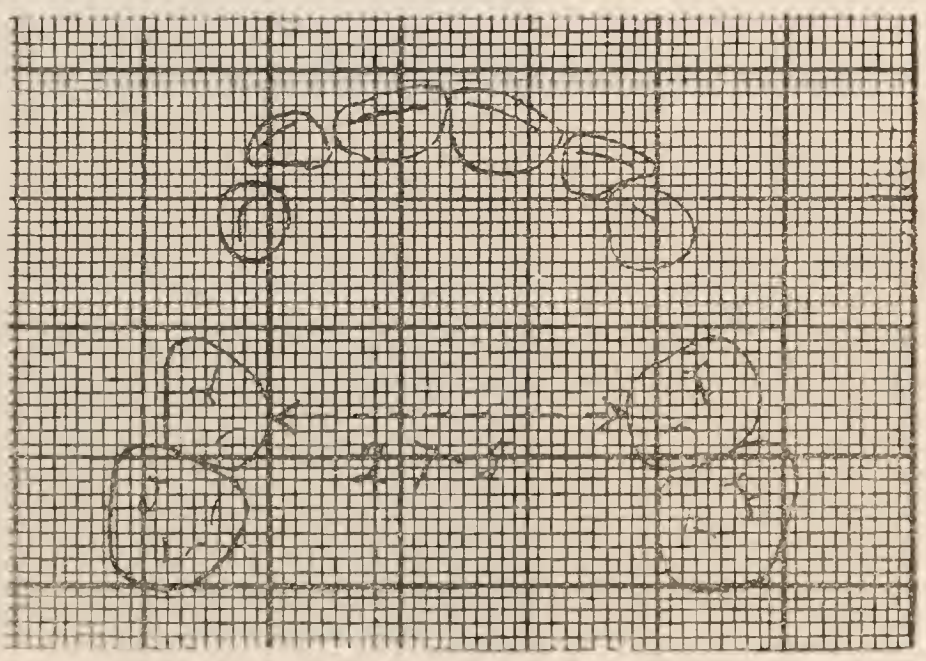


Fig. (*c*).
Upper arch of child at $9^{Y}\,2^{M}$.

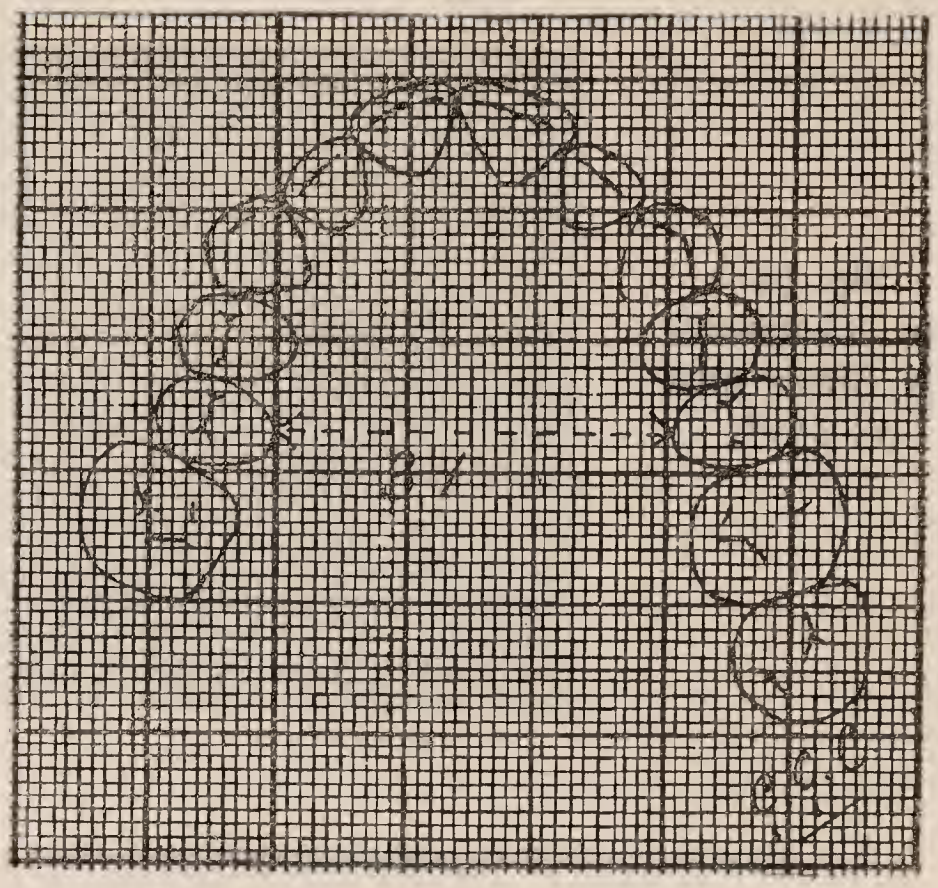


Fig. (*d*).
Upper arch of same child at $14^{Y}\,1^{M}$.

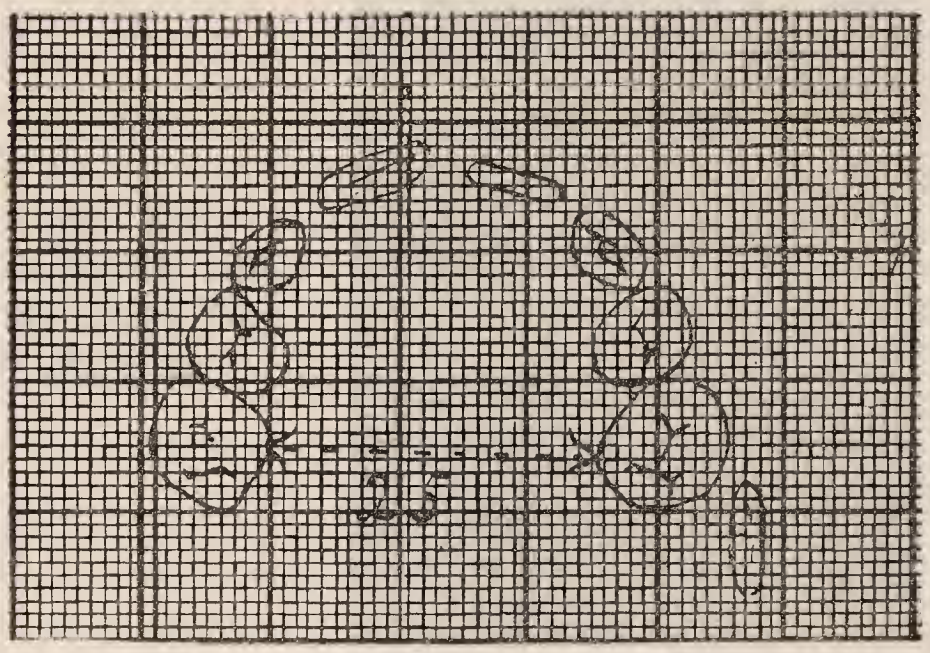


Fig. (*e*).
Mr. Turner's case.
Upper arch at $7_{Y}\,5^{M}$.
Adenoids removed at $9^{Y}6^{M}$.

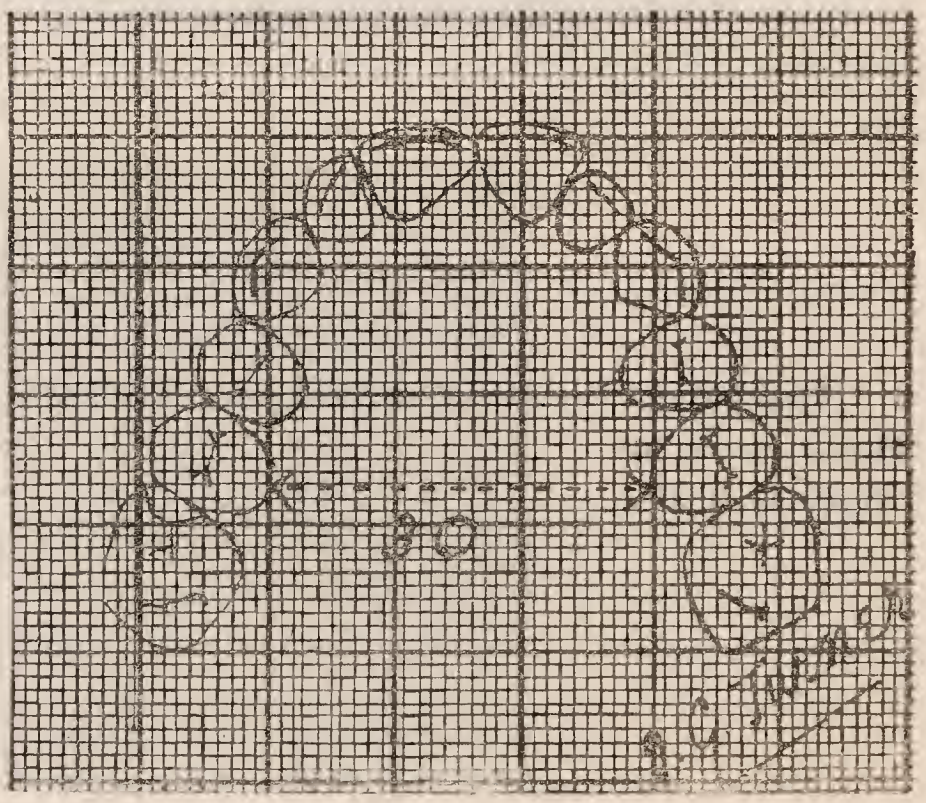


Fig. (*f*).
Mr. Turner's case.
Upper arch at $13^{Y}\,4^{M}$.

The lower models of the same child showed a width between the second temporary molars at 28 at five years, and 29 at nine years, and a width between the lower canines of 18.5 at five and 22.5 at nine.

The next figures (*c*) and (*d*) showed the arches of another child in which a measurement of 27.5 mm. between the second temporary molars had increased at four years to 31 mm., and that was, of course, absolutely without any treatment whatever.

The next figures (*e* and *f*) were of an extremely interesting case of Mr. J. G. Turner's. It showed one of the cases which Mr. Turner had exhibited some years ago at a meeting of the B.D.A., at which he had read a paper on the influence of adenoids on growth. The intercanine measurement, 21 mm. at the age of seven had become 23 mm. at the age of thirteen. The adenoids had been removed at nine years and six months, the distance between the first pre-molars and the first deciduous molars was almost identical, but the distance between the second pre-molars which had erupted say two years after the adenoids had been removed, exceeded the distance between the second temporary molars by no less than 5 mm. That was the point which Mr. Turner desired to lay stress upon in exhibiting the models and they gave a very graphic illustration of that increase.

On the motion of the President a hearty vote of thanks was accorded to Sir Frank Colyer for his paper, and the meeting terminated.

ORDINARY MEETING.

An Ordinary Meeting of the Society was held at the rooms of the Medical Society of London, 11, Chandos Street, W., on Wednesday, January 14th, 1920, Mr. G. G. Campion, President, in the chair.

The minutes of the last meeting were read and confirmed.

Mr. G. V. McMahon was introduced to the members as a new member of the society.

The following candidates were elected: Walter Alexander Crane, Edward Pitt, and Arthur Thomas Pitts.

Casual Communication.

The following Casual Communication was read:

Movement of a Single Molar Buccally.

By Mr. Harold Chapman, L.D.S.Eng., D.D.S.Penn.

At the last meeting our past President mentioned that much might be learnt from our failures. Whilst this case has not reached a stage when failure would be a correct description, nevertheless I learnt that I had not used my appliances to the best advantage within a month of starting treatment.

For the sake of brevity I will only refer to details that bear on the point in question.

Irregularity.

The upper arch is too narrow. On the right side the second temporary upper molar and first permanent molar are in lingual occlusion.

Treatment.

I decided to treat these two irregularities with one appliance, a Badcock plate. This was held in place by means of a spur in the $\underline{\text{E}}\rfloor$ under which the plate fitted and a spur on $\lfloor\underline{6}$ under which a spring was adjusted (C. S. Morris's method). The spur on the permanent molar was attached to a plain band, cemented to the tooth.

Before expanding both sides I considered it necessary to get $\underline{6}\rfloor$, which is in lingual occlusion, into correct relation with the corresponding lower teeth, so the plate was cut free of the temporary molars on that side. When the patient returned in less than three weeks, I found that $\lfloor\underline{6}$ had moved buccally, which was not desired, and that $\underline{9}\rfloor$ had remained in its original position. The screw had not moved the teeth as I had hoped, but the Morris spring had acted on the left molar, which I desired to remain stationary, as I had wished the plate to act on the other side. This came about owing to insufficient care in adjusting the spring when the plate was put in, or it was accidentally altered later. The movement is not sufficient to measure though it was obvious in the mouth.

Had I put the Morris spring on the other side of the plate, and suitably adjusted it, I have no doubt I should have obtained the result I desired.

I apologise to the meeting for bringing such a "casual" before you; I am sure those who use the Morris spring would have used it to the best advantage at the outset, and not as I did. Perhaps there are some who do not use this method of retaining plates—this, then, is another use for these springs; I hope it may be considered by such as a further point in their favour. To me, their original use is ample recommendation.

The President then read his Inaugural Address:

Orthodontics, a Study in Six Dimensions.

Provisionally and at the moment I define Orthodontics as:—

> The study of the normal relations of the dental arches in themselves and in their relation to a normal facial configuration; the study also of the nature and causation of abnormalities and the means of correcting them so as to restore as far as possible normal relations to the arches and a normal configuration to the face.

Definitions such as this have at times their uses, but with the ever widening circle of our knowledge they become in time antiquated and are then relegated to that dim twilight land the land of the ineffective and the obsolete.

Each of the two parts of the masticating mechanism which we call the dental arches consists of sixteen minor elements each of which may vary within wide limits from their normal relations to one another, and logically there can be no perception and recognition of the abnormal which is not based absolutely upon a preconceived knowledge of the normal. It is doubtless the general consciousness of this which is prompting the admirable studies which are now being made of the detailed relations of various elements in the normal arches of man. In pre-Darwin days it was usual to speak of the normal as being grouped into different "types," but the infinite variations found in these types was at first the very basis on which Darwin slowly built up his great theory and afterwards was one of the constant features upon which that theory focused the attention of mankind. And these variations, so infinite in their number, so slight and so subtle in many of their differences necessitated and compelled a different method of regarding what we call the "normal." The old idea of normal "types," or at any rate many of the connotations attaching to this term, has largely passed away and what we call the normal is now regarded by modern biologists and anthropologists as what is called "an array of variates." The variations comprised in any array of variates which together we call the normal, shade gradually by minute differences into what we call the abnormal, and the line of demarcation between the two has never in reality anything about it like the clear-cut outline of a text-book diagram. There is a graded transition between the normal and the abnormal through which the one passes almost imperceptibly into the other. If this be so it becomes obvious at once that a study of the variations in and between the normal and abnormal must become a quantitative and not merely a qualitative study. Anthropology has passed through this change and has become largely anthropometry. The subject of our special study—Orthodontics—must pass through

the same change and be investigated by similar quantitative modern methods. This change we can see already in progress and the first fruits of the method are now coming to hand. The foundations of the future science and art of Orthodontics are being laid and they are being laid surely and firmly in the intimate study by modern quantitative methods of the normal dental arches of man. This study is likely to be a long and laborious one, and it abounds in pitfalls, for as Sir James Paget said more than thirty years ago, "the higher we climb the hill of knowledge the steeper and more difficult does the ascent become." But if modern statistical methods seem to us intricate and difficult they also provide, for those who will take the trouble to handle them in the right way, necessary safeguards against hasty and imperfect generalisation.

I wish to speak to-day of Orthodontics as a study in six dimensions. The first three of these are the three dimensions of space as applied to each arch in itself and to the two arches acting together as the incisive and triturating part of the entire masticating mechanism. The fourth dimension is the relation of the normal or abnormal arches severally and jointly to the facial configuration. The fifth dimension is the relation of the various forms of abnormality to etiology and the sixth dimension is treatment.

If we take the first three dimensions together as the three dimensions of space so far as the two dental arches alone are concerned, we shall see at once that in these three dimensions are embraced all the minutiæ which have been so elaborately worked out in the relations of the several units of each arch to one another and the relations of the two arches to one another in the whole range of what we call normal and what we call abnormal occlusion. Altogether admirable work has been done by many workers in the past twenty years following the lead of Angle, in minute study of the relations of the many inclined planes of the cusps of the teeth and their importance under the masticating stresses in directing the teeth during eruption to right or to wrong positions in their respective arches, their importance also as interlocking factors in the maintenance of their normal positions and their importance too in the proper functioning of the two arches as triturating organs. But much yet still remains to be done to complete our knowledge of what we call the normal and to ascertain what are the factors which go to determine the different forms of arches which we see, and what are the relations if any between the sizes of the different teeth in an arch and the form which that arch comes to assume, and the relation of the sizes of the several teeth of an arch to the size of the arch as a whole. Here are problems still to be worked out in studies of the many normal variations which we meet in the examination of skulls with normal arches, and their gradual shading by minute differences both into one another on the one hand, and into the abnormal on the other—problems which will require years of concentrated research work and yet the knowledge of which when it has been acquired and when in addition we have learnt to apply it in practice may probably be very great.

At present we have no real knowledge of the various and variable quantitative relations of the dental arches in themselves, nor have we at present any agreed method by which they should be investigated and determined.

ORTHODONTICS: A STUDY IN SIX DIMENSIONS.

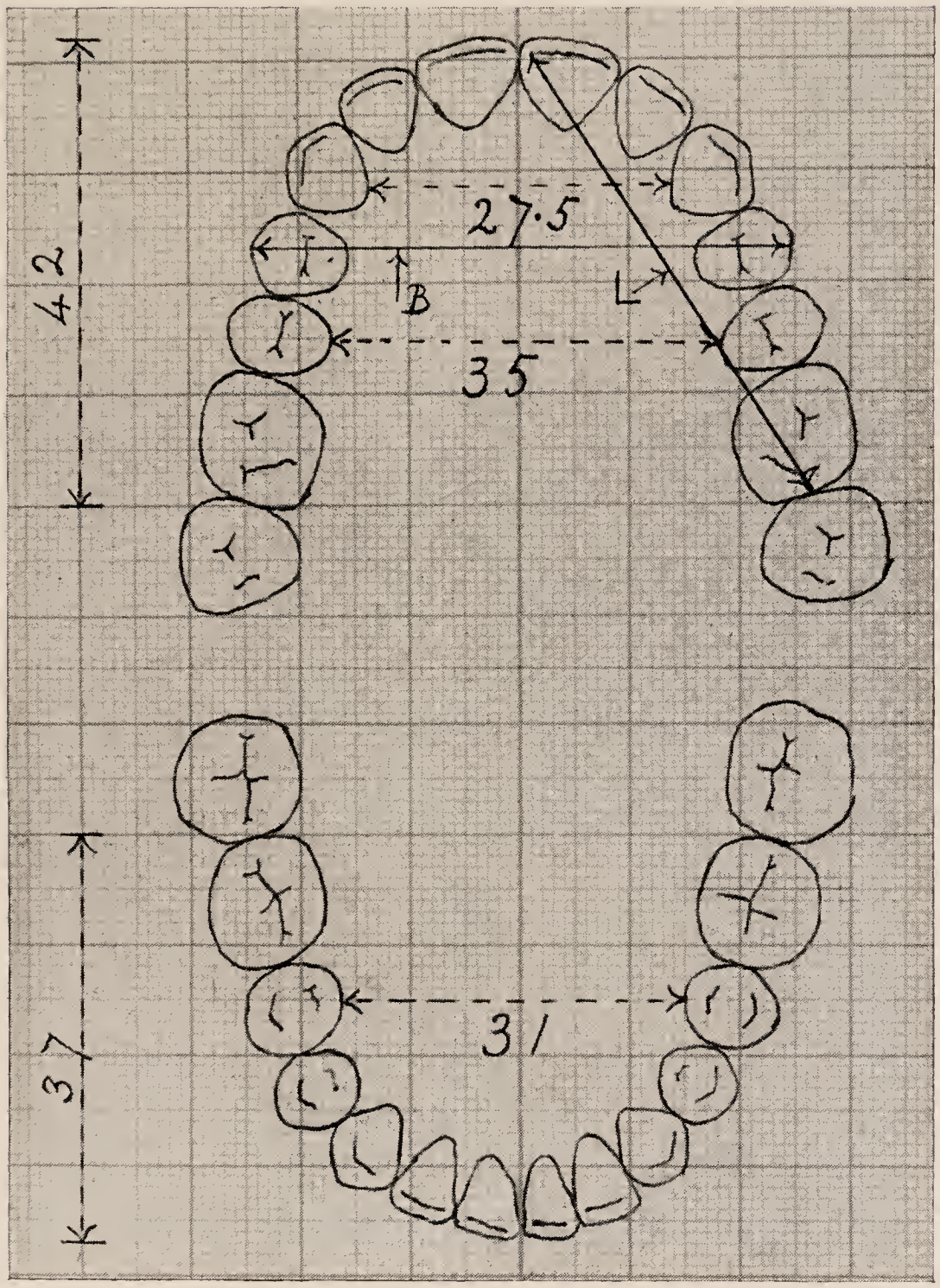
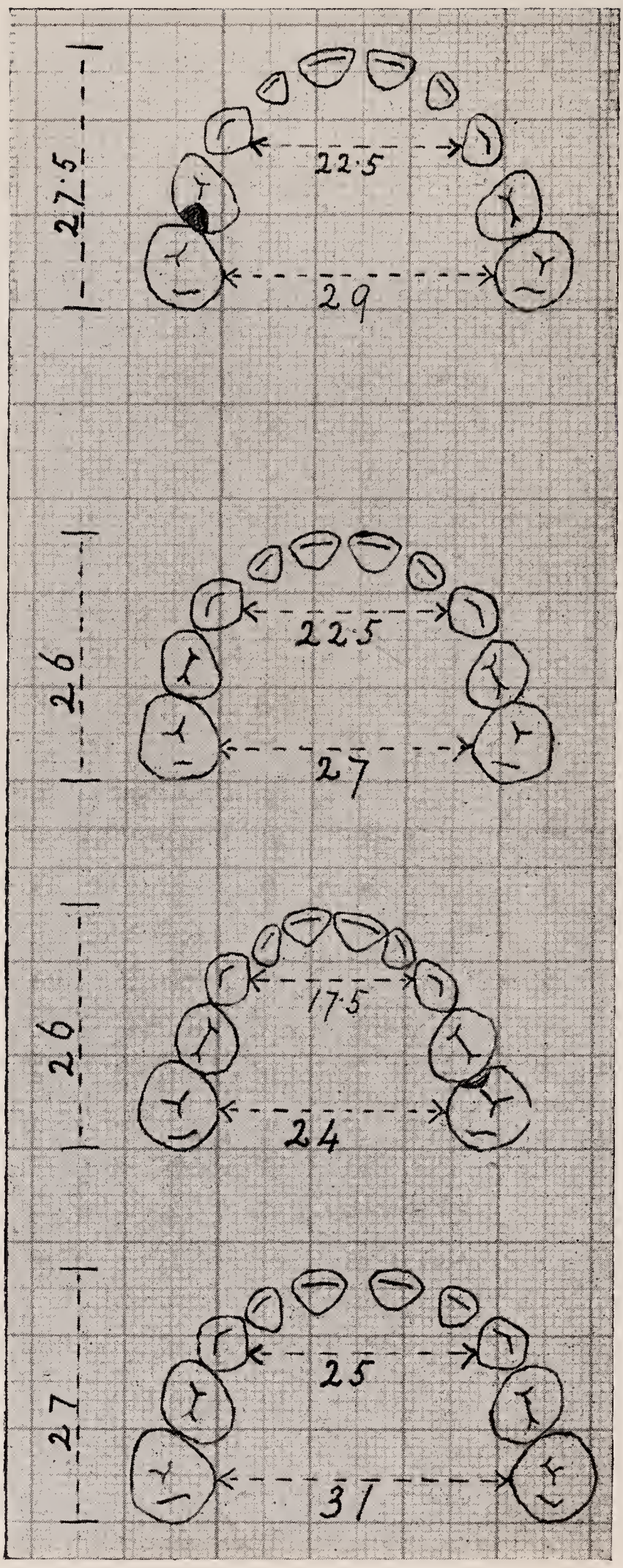


FIG. 1. NORMAL ARCHES, AGE 17 YEARS.

Drawn actual size on millimetre paper.

Breadth.—Inter Canine	27·5
,, ,, 2nd Premolar (Bogue)...	35·0
,, 1st Premolar (buccal)	49·3
Length (diagonal).—Mesial extremity of incisive margin of central incisor to centre of distal margin of 1st molar of same side...	47·3

$$\text{Breadth index} \; . \; \frac{49 \cdot 3 \times 100}{47 \cdot 3} = 104 \cdot 2.$$



Age
5 years 6 months.

Age
3 years 11 months.

Age
5 years 11 months.

Age
5 years 7 months.

FIG. 2. SUPERIOR ARCHES OF TEMPORARY TEETH, SHOWING VARIATIONS.

Some years ago I worked out an index to show the relative length and breadth of the upper arch in a manner similar to that employed in other anthropometrical indices. For length I took the distance from the mesial extremity of the incisive margin of the central incisor to the centre of the distal margin of the masticating surface of the first molar on the same side. For breadth I took the measurement between the most prominent point on the buccal surfaces of the two first premolars. The breadth multiplied by 100 divided by the length gave the breadth index of the arch. (Fig. 1.) Pont had previously made careful studies of the relative sizes of the teeth and their relations to the arch as a whole and Hawley constructed a geometrically normal arch to conform to similar data which he acquired. But anthropology does not smile upon attempts to compress its variants into geometrical formulæ like that which has been amusingly designated as "Bonwill's Law," and a geometrically constructed arch perhaps runs the risk of being more geometrical than normal, for it would seem to necessarily lack many of the variations, which we have seen the normal to include. Lately I have come to value highly Bogue's measurement across the palate between the two second temporary molars and at a later age between the two second premolars. (Fig. 2.) But whatever arch measurements may ultimately be settled upon by a general consensus of opinion we know already most, if not all, of the variations from the normal which fall within these three dimensions; they include the mesiodistal variations from the normal included in Angle's Classes II and III, variations in the breadth of arches, open bite, and variations from the normal in incisor over-bite; variations in Spee's curve, and the various abnormalities of position and inclination of individual teeth and groups of teeth which have been so variously labelled supraversion, infraversion, torsoversion, proclination, etc., etc. All these studies of the arches and all the abnormalities embraced under these and similar terms come within what I call the first three dimensions of our subject—the three dimensions of space as applied to the dental arches considered as two units, and to the relations of the several elements of which these arches are each compounded.

Fourth Dimension.—Facial Configuration.

I come now to what I call the fourth dimension of our subject —the relation of the normal or abnormal arches both severally and jointly to the facial configuration.

Of close study of the relation of normal and abnormal relations of the arches with facial configuration there has up to the present been very little and I agree wholly with a recent statement of Lischer's that when this work has been done the result will be to break down many of our preconceived ideas of the whole subject. We talk of "harmony" and "disharmony" in the relations of the dental arches to the facial configuration, but these words used in this connection seem to partake very much of the nature of what anthropologists in their studies and descriptions of primitive man term "holophrases"; and a "holophrase" is merely the verbal form or sound with which civilised no less than primitive man endeavours on the one hand to give expression to his inchoate and quite imperfect knowledge, and on the other hand to camouflage

as far as possible his very real ignorance. An amusing example of a "holophrase" was once given me by a medical man who had spent some time in one of the Pacific islands. It was an island to which western civilisation had only recently penetrated, an island where the memory of some of the older inhabitants went back easily to the good old days of cannibalism, and when before the advent of western ideas and habits the animals which we call cattle were unknown. When cattle were imported, the islanders were, of course, much impressed by the arrival and dignity of these strange beasts. They heard the individual animals called now by the name of bull, now by the name of cow, and being at first inappreciative of the difference between them they invented a holophrase to embrace them all and they became known individually and collectively both then and afterwards as "bull-a-ma-cow."

The word harmony when applied to the relation of the dental arches to the facial configuration seems to partake in some degree of this nature of a holophrase; it seeks to express something of which our knowledge is quite imperfect and to camouflage with as much dignity as possible our real ignorance of the nature and relations of the several elements or factors which go to make up the whole. The task lies ahead of us to analyse it, and find out something more of its nature and proportions. Mankind suffers many of its lapses and retrogressions in the slow upward struggle after what we call "progress" by continually allowing itself to be side-tracked from the paths pointed out by its greatest minds, and we may doubtless learn much from methods akin to those which are employed by artists in their studies of the human face.

I have found much help in studying the correlated abnormalities of the arches and face by a line drawn from the nasion or bridge of the nose to the most prominent point of the chin. In what seem to me the best of the normal and subnormal profiles this line nearly touches the posterior border of the nostril. The upper lip projects in front of this line about one-quarter or one-third of the amount of the projection of the nose. The lower lip projects somewhat less. If a horizontal line be drawn at right angles to the vertical one at the nasion, a second horizontal one at the lower border of the nose, and a third the same distance below the second as the second is below the first, the chin is always below this third line.

Figures 3, 4, 5, 6 show sketches of normal and Figures 7 and 8 abnormal faces. Figures 9, 10, 11, 12 and 13 photographs of subnormal and abnormal faces.

The difficulty of any study of this kind is that there are really no fixed points which can be readily used and applied to both young and adult faces. To find such points or a reasonably stable basal line is a desideratum which awaits research and determination.

Fifth Dimension.—Etiology.

The causes of dento-facial abnormalities have been assigned to two groups, extrinsic and intrinsic, and of the former we know perhaps a good deal, of the latter we know little. In a brief and rapid survey of our subject as a whole, it is difficult and perhaps unnecessary to summarise our knowledge of to-day. It may be helpful to try and search for a way by which it may be made more complete in the future and since these abnormalities are essentially

the manifestations of abnormal development, it would seem that the careful study of development, both of normal and abnormal cases, may be one of the paths leading to a fuller knowledge of

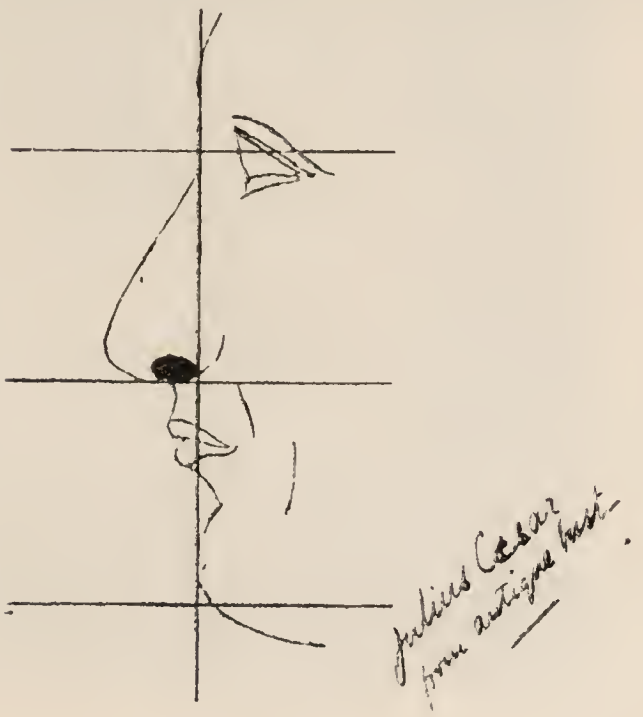


FIG. 3.

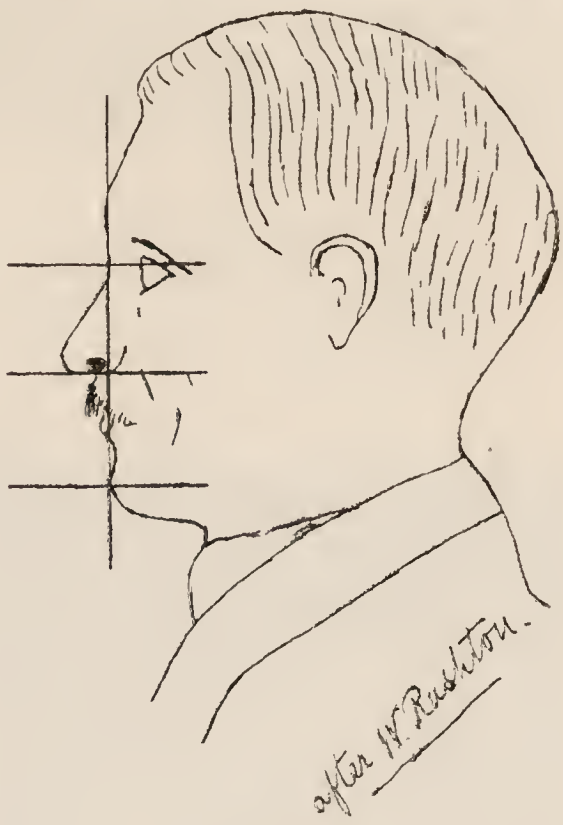


FIG. 4.

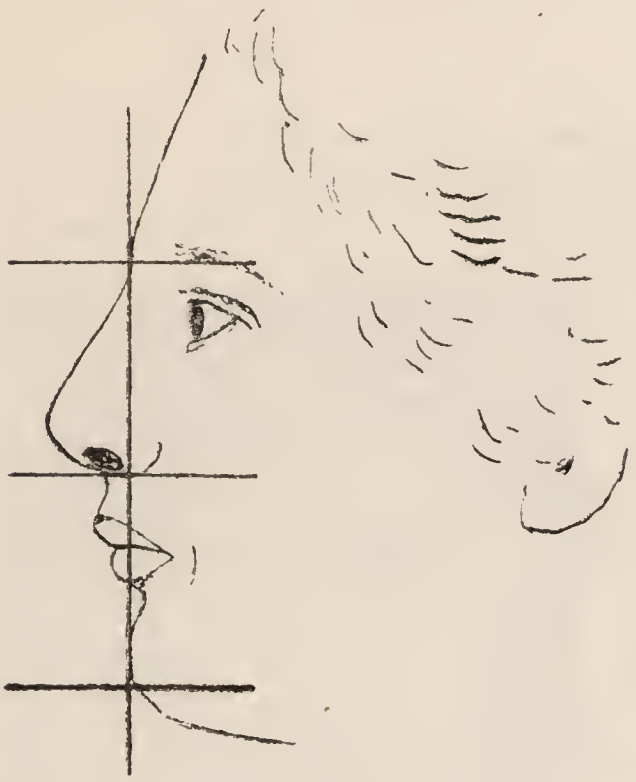


FIG. 5.

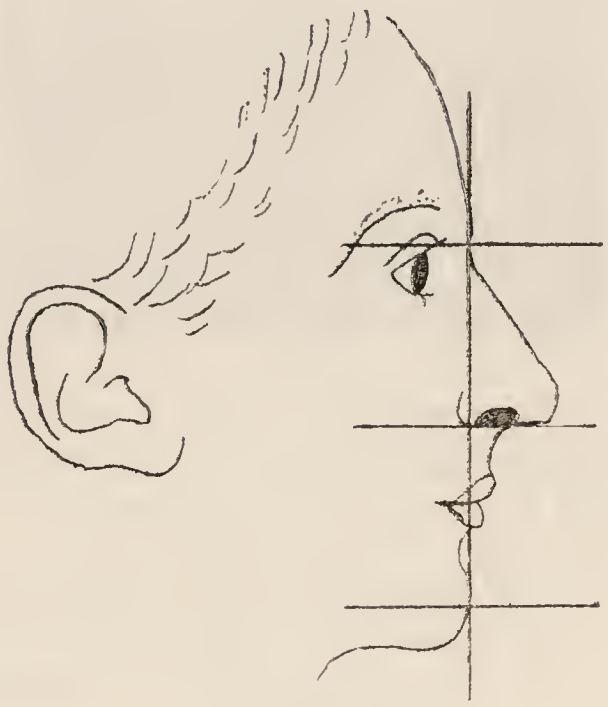


FIG. 6.

etiology. The development of the dental arches in themselves and in their relations to the face seems to be both sporadic and spasmodic. It goes on at one place, it seems to be arrested at another, it is in active progress at one period, it is quiescent at another. It is contingent doubtless, for these variations on conditions of general health and environment and its variations must be studied in close relation to them.

Sir Frank Colyer gave us at our last meeting a most valuable contribution in the form of the progressive development of the dental arches of three individual children, through all the stages of childhood. Studies of this same kind in other children will no doubt

show wide differences both in form and in time, and these variations when correlated with conditions of general health and surroundings may point to conclusions which we at present lack; but this search must also be extended to the relations of the dental arches themselves to the facial configuration, and I wish to bring before you a few results from some measurements taken recently on this point.

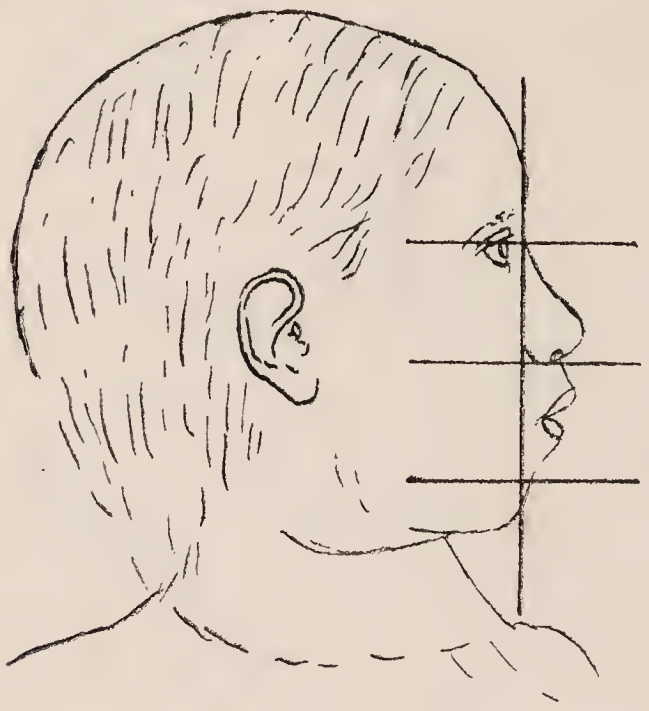


FIG. 7.

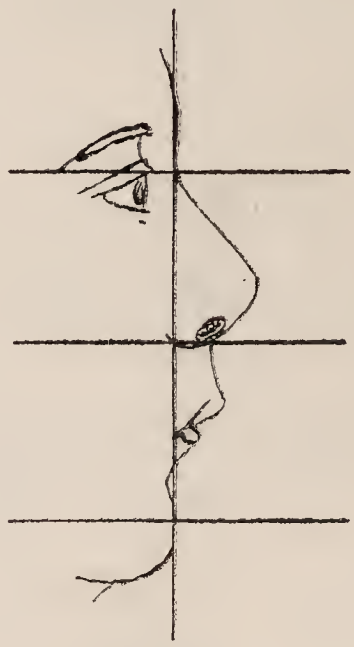


FIG. 8.

Justice seems not yet to have been done to that admirable instrument with the less admirable name invented by Dr. Sim Wallace and improved by Mr. Northcroft. I mean the prosopometer. It enables us to get sagittal measurements of the anteroposterior development of the face from the line of the external auditory meatus without the distorting error of diagonal measurement, and the results seem promising for further investigations.

From a number of measurements of faces of all kinds and ages I have selected a few from three groups, aged respectively nine to eleven, fifteen to sixteen and adult. Those cases selected were all with normal or subnormal arches and facies and in this respect are suitable for comparison.

The measurements taken were as follows:

A. From the nasion to the lower border of the nose.

B. From the nasion to the incisive margin of the upper central incisors.

C. From the nasion to the masticating surface of the upper first molars.

D. From the nasion to the lower margin of the mental prominence of the mandible.

E. From the incisive margin of the lower central incisors to the lower margin of the mental prominence of the mandible.

F. From the line joining the two external auditory meatuses to the nasion.

G. From the same line to the incisive margin of the upper central incisors.

H. From the same line to the tip of the mental prominence of the mandible.

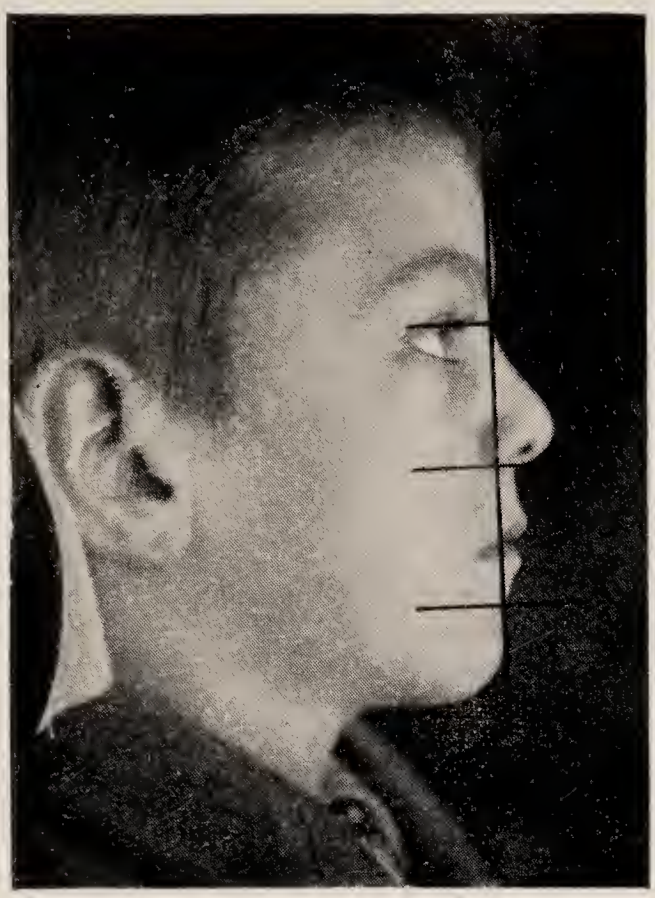


Fig. 9. Sub-normal. Age 10.

Fig. 10. Adenoids removed one year previously. Shows also condyle path and angle of mandible.

Fig. 11. Full face of Fig. 10.

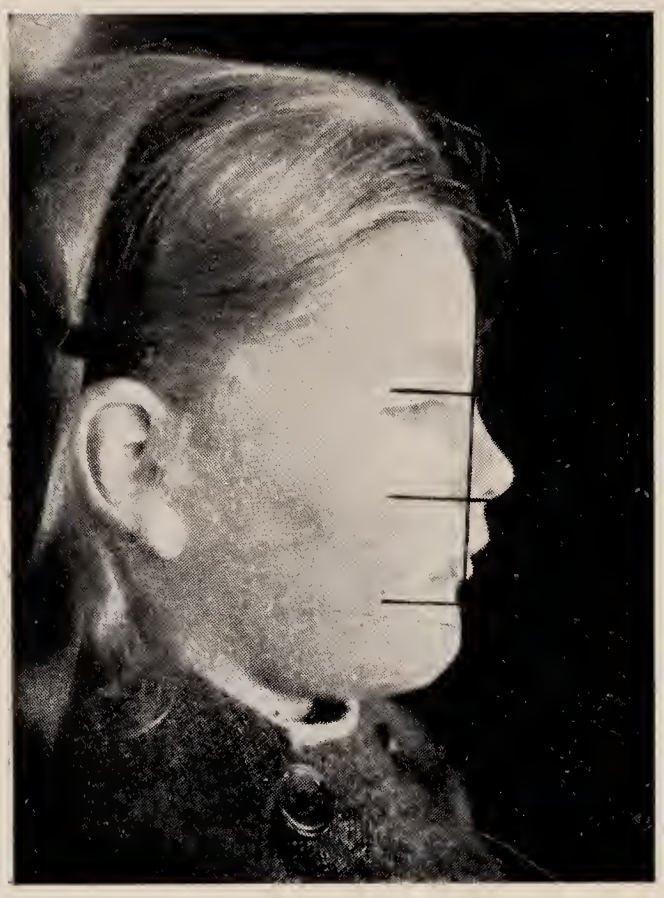


Fig. 12. Angles Class ii., Div. 1.
No adenoids or nasal stenosis.

Fig. 13. Angles Class ii., Div. 1.
Adenoids.

The lines of measurement are indicated on the accompanying diagram, Fig. 14.

The last three measurements are sagittal measurements which are easily made with the prosopometer.

The callipers used for the first five measurements of the series were fitted with a curved plate the arc of a circle of about an inch diameter, which enabled it to be securely seated and held on the nasion while the measurements were made.

The measurement to the masticating surface of the molars was taken by means of a steel rod spanning the molars, the thickness of which was afterward deducted.

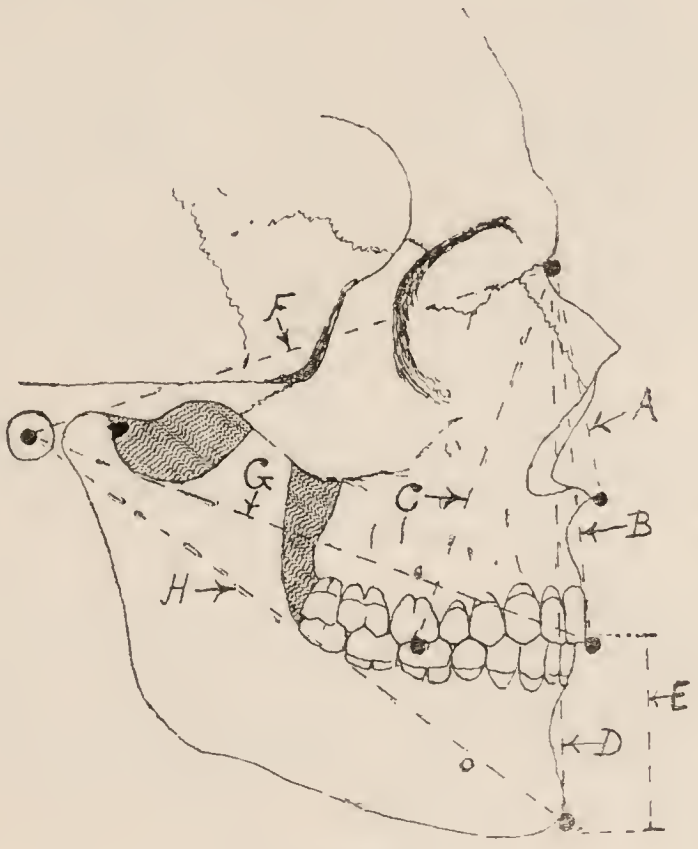


Fig. 14.

Table I gives the measurements in millimetres of the three groups of cases with the means, standard deviations and mean increases, &c.

Table II. gives for more ready comparison only the means, standard deviations and mean increases.

These groups of measurements, while of course quite insufficient for establishing any criterion of the normal, yet seem suggestive enough to justify a large series being obtained from which the standard deviation might be calculated in normal and subnormal cases, and provide a criterion which might prove of use in approaching the etiology of the subject from the standpoint of development.

The many and multiform variations of and from the normal and also the causes of these variations are all comprised in what I have ventured to call those five dimensions of our study, and it would seem that any scientific classification of dento-facial abnormalities must also embrace these same dimensions. The final and definitive classification will not be possible until each of these dimensions shall have been more intensively studied and until our knowledge of all of them is more complete than it is at present. But the advance which has been made in the last thirty years gives good augury for the future. Time was within the

TABLE I.

Line on Diagram.	Age in years.	No. of Cases.	Mean.	S.D.	Max.	Min.	Mean Inc.
Nasion to lower border of nose A.	9 to 11	10	42.9	±2.55	47	38	
	15 to 16	9	49.3	±2.26	52	45	
	Adult.	10	53.2	±3.75	60	49	10.3
Nasion to edge of upper incisors. B.	9 to 11	10	64.0	±2.19	69	61	
	15 to 16	9	72.6	±4.11	78	65	
	Adult.	10	76.7	±4.56	86	72	12.7
Nasion to upper molars. C.	9 to 11	10	67.1	±2.53	72	63	
	15 to 16	9	74.0	±4.3	80	66	
	Adult.	10	80.6	±4.04	87	74	13.7
Nasion to chin. D.	9 to 11	10	100.1	±2.60	103	95	
	15 to 16	9	111.4	±5.49	119	102	
	Adult.	10	122.8	±7.67	136	114	22.7
Lower Incisors to chin. E.	9 to 11	10	35.8	±1.17	38	34	
	15 to 16	9	40.8	±1.83	43	38	
	Adult.	10	44.7	±3.34	51	42	8.9
Auricular meatus to nasion. F.	9 to 11	10	89.9	±4.1	99	85	
	15 to 16	9	95.6	±3.16	99	89	
	Adult.	10	100.4	±3.87	105	92	10.5
Auricular meatus to U. Incr. Edge. G.	9 to 11	10	86.6	±2.97	91	82	
	15 to 16	9	94.0	±4.29	102	89	
	Adult.	10	100.6	±6.36	113	90	14.0
Auricular meatus to chin. H.	9 to 11	10	98.6	±3.67	105	92	
	15 to 16	9	104.3	±4.9	109	96	
	Adult.	10	119.9	±8.65	138	103	21.3

TABLE II.

MEANS AND STANDARD DEVIATIONS.

Line on Diagram	9 to 11 years.	15 to 16 years.	Adult.	Mean Increase.
A.	42.9 ± 2.55	49.3 ± 2.26	53.2 ± 3.75	10.3
B.	64.0 ± 2.19	72.6 ± 4.11	76.7 ± 4.56	12.7
C.	67.1 ± 2.53	74.0 ± 4.3	80.6 ± 4.04	13.7
D.	100.1 ± 2.60	111.4 ± 5.49	122.8 ± 7.67	22.7
E.	35.8 ± 1.17	40.8 ± 1.83	44.7 ± 3.34	8.9
F.	89.9 ± 4.1	95.6 ± 3.16	100.4 ± 3.87	10.5
G.	86.6 ± 2.97	94.0 ± 4.29	100.6 ± 6.36	14.0
H.	98.6 ± 3.67	104.3 ± 4.9	119.9 ± 8.65	21.3

brief space of memory of many of us who are here to-night, when we were content to classify what we called dental irregularities into groups on which we dabbed such labels as V shaped arches, saddle-shaped arches, anterior protrusion, protruding canines, etc. ;

these represent only a primitive stage in the history of the subject, and we have left them far behind. Angle's classification has since come and may in due time be also expected to go : it, too, represents an old tendency in medical history, the tendency to appear exact by disregarding the complexity of the factors and variations involved. One of America's representative men, Ralph Waldo Emerson, told us that " if a man fasten his attention on a single aspect of the truth and apply himself to that alone for a long time, the truth becomes distorted and not itself, but falsehood." What we call the scientific side of man's mind is not a whit less prone than what we call its religious side to build up idols of its meagre finger breadths of knowledge and to call those idols the truth. Angle's classification has long seemed to me such an idol, its very simplicity and definiteness are perhaps no very inexact measure of its inadequacy, for by concentrating our attention primarily and most insistently on the relations of the two arches to one another in one dimension of space and ignoring the other four cognate dimensions to which I have referred it presents in its way a striking illustration of Emerson's dictum, and despite the very real practical convenience with which it enables us to indicate with a numerical label certain broad categories of abnormalities *in occlusion*, after studying these in their wider maxillo-facial relations, one comes gradually in time to regard it with the uncomfortable sort of feeling that a structure which is balanced on one leg when it really needs five is not a structure which has about it much assurance of permanence.

Of later classifications there are those of Norman Bennett and G. Villain, of these the latter is entirely etiological. The former, Bennett's, is wider in scope and is suggestive of the truth in two ways ; first in reflecting adequately the complexity of the whole subject itself, and secondly by bringing us up repeatedly against those unknown factors which go to determine the normal or abnormal development of the associated osseous structures. Recent researches on the results of dietetic modifications of foods like those of which Mrs. Mellanby gave us in November so brilliant a demonstration may well prove of great significance, and such dietetic factors acting through or interacting with the functioning of the ductless glands may give the clue to a knowledge of the etiology of our subject for which up to the present we have sought in vain.

I have now outlined five of the six dimensions into which I conceive the subject matter of our study to extend : of the sixth dimension or treatment, it is unnecessary to say anything here and now. It presses itself insistently on our attention and recalls us again and again to its further study by the incessant mingling of success and failure. It is well able to maintain for itself its rightful place in the whole story of the subject ; a story which is being slowly unfolded by this and other kindred societies and workers, and a story the end of which is not yet in sight.

The PRESIDENT said he did not know whether the members would care to discuss the address, but it was open for them to do so if they wished.

Mr. NORTHCROFT said that if it was not the wish of the Society that the President's very valuable address should be discussed, it rested upon him to propose a very hearty vote of thanks to the

President for the pleasure he had given the members that evening. He had listened with great interest to the address, and although he should like to discuss it more fully in private with the President, he did not think that the present time was opportune. There was great food for thought in the breadth of view the President had taken of the whole subject and in trying to focus the attention of the society on the necessity for careful research and thoroughness in all the steps that were taken to elucidate many problems connected with the study of Orthodontics.

Mr. RUSHTON asked whether it was the custom of the Society not to discuss the Presidential address.

The SECRETARY (Mr. Harold Chapman) said it had been customary not to do so, but there was no ruling. As he had some idea of the nature of Mr. Campion's address and that it would partake, to some extent, of the nature of a Paper, he wrote and asked the President if it would be open for discussion, and he replied " Yes."

Mr. RUSHTON said it was not that he particularly desired to discuss the address, but he simply wanted to know, as a point of order, whether a Presidential address could be discussed. He thought in a matter of that sort the preference of the Society or the preference of the President as to whether his paper should be discussed might fairly be brought before the Society before the vote of thanks was proposed and seconded.

The PRESIDENT said it was apparently a matter of custom and habit, and it was for the meeting to decide. He did not wish to ask the members to discuss the address as he realised that it was hardly a thing, perhaps, that lent itself to immediate discussion.

Mr. SCHELLING said that the Presidential address had always been regarded as privileged, and that members should not now presume to discuss it as previous notice and an invitation to do so had not been given them.

Mr. BADCOCK wished very heartily to second Mr. Northcroft's proposal of a vote of thanks to the President for what had been an illuminating address. Its breadth of view, as Mr. Northcroft had said, was remarkable. The members had been indebted to Mr. Campion in the past for many original observations on the science of orthodontics, and Mr. Campion had continually pointed out the road to follow up the subject. The amount of labour in preparing the diagrams which had been shown must have been very great, and he thought the method of sketching which had been suggested had an advantage over any other that he had heard of in recording such matters with such accuracy. He did not know whether he should ever find himself spending the time necessary to record his cases in that way, but it was an exceedingly admirable method. There were various points which at some future time one might be anxious to discuss, but he would confine himself to seconding very heartily the vote of thanks.

The vote of thanks was then put and carried with acclamation.

The PRESIDENT thanked Mr. Northcroft and Mr. Badcock for their kind remarks, and the members for the way in which they had passed the resolution.

A vote of thanks was accorded to Mr. Harold Chapman for his Casual Communication, and the meeting adjourned till February 11th.

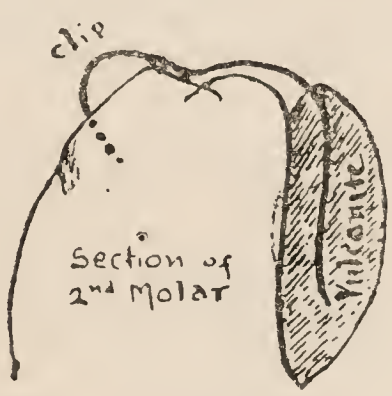
ORDINARY MEETING.

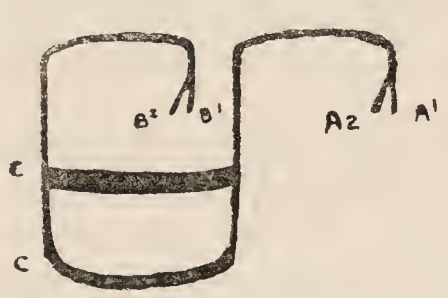
An ordinary meeting was held on February 11th, 1920, at 11, Chandos Street, W.1, the President (Mr. Campion) being in the chair.

Casual Communications.

Mr. B. Maxwell Stephens exhibited a form of clasp for retaining plates. He pointed out that the device was simply a means of retaining the plate by means of a proximal hook. At times instead of a crib, proximal clips may be used. These consist merely of the crib with the bucco-cervical portion cut away, the points A_1 B_1 to A_2 B_2, so as to close into the buccal portion of the proximal space (it is not found that separation of the teeth follows). The portions C—C are flattened to obtain hold on the vulcanite.

Besides using these in particular cases, incidentally a crib may not have been made deep enough, preventing the plate from sinking home. This modification enables one to readjust at once the wires passing across the occlusal surface, and will allow the plate to settle into fit while a steadying clip can be obtained, as explained previously.





The President asked what the effect of mastication was on these wires, and whether they got bent out of shape and loose. He knew that cribs did.

Mr. Stephens said that the wires did tend to have this action, and it was in order to minimise it that he used platinised gold, which was stronger than copper alloy. If this did occur there was still another clip available.

Mr. Harold Chapman showed some models of unusually small teeth in a girl eight years of age, rather small of stature, but not extremely so. In view of Mr. Buxton's paper, which was to follow, he thought it might be useful to pass round this exhibit. The upper incisors and the upper and lower molars were small, though the lower incisors seemed to be more nearly the normal size.

Mr. L. H. Dudley Buxton then read his paper:

The Teeth and Jaws of Savage Man.

The original choice of the title of 'Teeth and Jaws of the Savage" for this paper was due mainly to the idea of avoiding the word

"primitive." It was an attempt to find a term that would express what the old Greeks call the Βαλανήφαγοι ἄνδρες the men who ate acorns as opposed to the men of culture who ate some form of wheaten bread—to contrast, in fact, the men who live directly on whatever they can pick up and the men who employ a cook. Possibly the term is very ambiguous, but it will be clear at least that the discussion will turn on the teeth of persons who are seldom if ever represented among the visitors to a dentist's consulting room.

I feel some hesitation as a humble anthropologist in discussing teeth, about which I have but scant knowledge, before a gathering whose profession and pride it is to make teeth their special study. I only hope that I may be able to remind you of one or two interesting facts which may have escaped your notice in the ordinary routine of practice.

In looking up the records of the Odontological Society, I found that in 1869 Mr. J. Mummery,* in a valuable paper, dealt with the teeth of prehistoric man and those of modern savages. I was specially interested to find that Mr. Mummery referred to some of the specimens, among which I have the privilege to work in Oxford. He was, however, mainly interested in the question of dental disease whereas it is rather the occlusion of the jaws that I propose to discuss this evening.

Dr. Rolleston in his report on the human remains from British Barrows (published in Greenwell and Rolleston's "British Barrows"), alludes to Mr. Mummery's article with a view to elucidating certain problems connected with early man.

I think I could not do better than follow in the footsteps of such distinguished predecessors and try to apply the same method in dealing with certain crania that I excavated in Cyprus just before the war.

There are two types of savage man to whom I wish to draw your attention especially, the Eskimo and the Australian Blackfellow.

The teeth of the first have been discussed by Thomson† and Knowles,‡ who have shown that they are developed to a remarkable degree. Not only are the teeth generally very big and regularly set in an arched palate, but also the third molar, instead of being an atrophied stump, is developed to great proportions. They possess an edge to edge bite. The crowns of the teeth are sometimes deeply worn, often obliquely, and are used in chewing with a sweeping motion so as to fulfil the function of shears. As a corollary of this shear-like use of the jaws, Knowles has shown that the glenoid fossa is shallow and the articular eminence is somewhat modified. Let us try and consider the explanation of this curious type of jaw. It appears that the Eskimo are earnest disciples of Fletcherism. They may be said to chew almost perpetually, especially during the long winter evenings when the sun does not come above the horizon and the dwellers in the Arctic have a good deal of enforced leisure thrown upon their hands. They chew the skins which form their only form of clothing in order to render them supple. It is a primitive form of leather work, requiring considerable muscular strength

* J. Mummery, "On the Relations of Dental Caries in Aboriginal Races," *Trans. Odont. Soc.*, November, 1869.

† *Journal Anthr. Inst.*, vol. 33, 1903, fo. 135 sq.

‡ Canadian Geol. Survey, *Mus. Bull.* No. 9, Anthr. Series No. 4.

in the jaw, and it is possibly the explanation of the curious development that we see."*

The Australian aborigines are also in possession of a similar type of large dentition, again remarkable for the relatively big size of the third molar. There are many of them still living under stone-age conditions, which necessitate very hard wear on the jaw.

Having this very marked type before me it seemed profitable to examine the crania of other savage peoples to see if a parallel could be found. I examined first a series of Negro skulls.

The Negro south of the Sahara has many different forms of diet, but the pastoral element is so strong that often a soft diet may be largely or almost entirely indulged in. One gets here again, however, among the grain-eating tribes and possibly everywhere, a crown that is worn away sometimes down to the gums. But this is not uniform. In some cases in spite of a marked edge to edge bite the teeth are little worn, and from a series of African skulls that I examined recently I should say that the wearing showed very little parallelism with that of the Australians. The temporal muscles, however, showed a large area of attachment and the mandible was in many cases markedly heavy. Of the teeth themselves it may be said that they are large, and in order to avoid the crowding that would otherwise ensue there is what is usually termed marked alveolar prognathism. The wisdom teeth are small. The glenoid fossa appeared among my specimens to be fairly deep. Shallow cases, however, did occur, but in no case could I find anything that would compare with the Australian crania. The condition was closely paralleled in North Africa by a late predynastic skull from Egypt. This skull did not possess a shallow glenoid fossa, but had the same characteristic oblique wearing of the teeth so often associated with a shallow glenoid, but although the palate was very large, the teeth that remained were smaller than the average Australian and the wisdom teeth were very small.

The cultural state of these predynastic Egyptians is much to our purpose. They were sufficiently advanced to represent already, if it may so be termed, a "decadent" civilisation, their pottery, for instance, is not so fine as it was in the earliest period, they appear to have developed considerable trade relations, and, what is more interesting, their copper daggers are almost indistinguishable from the early Cypriot types.

Among early British teeth that I have examined recently the neolithic, although worn and showing no traces of decay, presented the characteristics we are inclined to associate generally with primitive races, a large series of crania probably of Roman date in Oxford possessed the same form. A Romano-British skull, however, that I excavated at Frilford in 1912, although worn and possessing an edge to edge bite, showed no trace of the oblique surface which we have associated with primitive life. The glenoid fossæ were deep, and the nearest parallels that I could find, odontologically

* Hooton has recently (*Am. Jour. Phys. Anthr.*, March, 1918) called attention to certain Eskimoid characters in Icelandic crania, which he ascribes to similarity of diet. Unfortunately he does not discuss the teeth; he draws attention to the striking similarity between Icelandic and Eskimo skulls in the prevalence of the mandibular torus, the palatine torus, the thickened tympanic plate and the sagittal elevation of the cranial vault.

speaking, among the crania at my disposal, to my Frilford remains were among a series of crania from Nigeria which possessed closely similar characteristics; it could also be paralleled among some Andamanese crania.

We have now got to the stage when we can profitably inquire into what was my original reason for examining these questions, namely early copper-using man in Cyprus. During the autumn and winter of 1913 a large number of bronze-age teeth passed through my hands, and I was rather surprised to find that these teeth and jaws presented most of the characteristics of the modern Cypriot—as far as I could judge.

I failed to find any marked difference between the ancient and modern types. Unfortunately the fragments of bronze-age crania capable of being measured were extremely few. The bigonial width of two female jaws was 95 mm. and of one Ptolemaic jaw 98 mm., the variation in different races is so great that little can be judged from this. The same measurement on living males was 106 mm. in the case of some villages and 109 in the case of others; this contrasts strongly with the Eskimo, who appear to have a bigonial breadth of about 131 mm. in the males and 126 in females.

The palatal index fails to satisfy in any way any criterion. Such few Cypriot crania as were available place the Cypriots both ancient and modern in the same class as the Australians and the Eskimo, an obviously unsatisfactory result as their palates are extremely different in size, although comparatively similar in shape.

I am for the moment then left without any satisfactory numerical criterion, absolute measurements are unsatisfactory because they depend on the size of the individual and numerous other factors, indices have been shown not to help us in our problem; there remains the possibility of description. I failed to find any marked difference between the ancient and modern Cypriots, and no jaw that I have examined, ancient or modern, possessed the shallow glenoid fossa and oblique wearing of the teeth which might have been expected. I must admit that my series was a small one. There certainly seemed to be two types, one had a very much greater jaw measured transversely—from angle to angle—than the other, this difference could not be accounted for by a difference in habits or in food but only by a difference in racial characters, which were most clearly defined in the cranial index and in the nasal index. These two types, broad and narrow jaws, as far as our evidence goes have been in Cyprus side by side from very early times.

In the bronze age then we have represented in Cyprus a type of man that has survived till to-day. I was anxious to discover how far the bronze-age man was, to judge from his teeth and jaws, savage. The conclusion that I have come to is that he was not. But from that question has arisen the larger question as to how far we can really estimate a savage by his teeth and the occlusion of his jaw. The similarity of the Eskimo and the Australians in certain features shows that this form of occlusion is not entirely racial, and again it can be paralleled in neolithic man, secondly, although speaking generally savage peoples, as far as our evidence goes, do tend to have a low palatal index, yet some have quite a high index. On the other hand, there are indications that at least to a certain

extent, the bigonial breadth may be a racial feature, although it is not always so.

Further, the descriptive features have failed to show any close racial or cultural parallel. Let me resume my previous statements.

Name of Tribe.	Glenoid Fossa.	Wear of Teeth.
Eskimo	Shallow ...	Oblique wear.
Australian	,, ...	,,
Predynastic Egyptian ...	Deep* ...	,,
Neolithic British	,, ...	,,
Early British (? Roman Period)	,, ...	Oblique to slight wearing.
Modern Negro	,, ...	Slight wearing.
,, Andamanese ...	,, ...	,,
Romano-British Frilford ...	,, ...	,,
Cypriot, Bronze Age ...	,, ...	,,
,, Various periods ...	,, ...	,,
,, Modern	,, ...	Slight to no wear.

Although this would not appear from the table, I am inclined to believe that there is a high degree of correlation between the depth of the glenoid fossa and the degree of wear of the teeth.

Professor Thomson† has shown that the pull of the temporal muscles have an important effect on the shape of the cranial vault, so that the study of the different types of occlusion may, quite apart from any other respect, be of very great value in helping to solve one of the sides of that very vexed question, the factors determining the cranial index.

We have rather stated a problem than arrived at any conclusions. To put the matter briefly, how far are certain characteristics that we are accustomed to associate with savage man the result of purely mechanical features. The answer to this question should be of service in endeavouring to correct some of the abnormalities which are rare, or almost entirely absent from savage man, but extremely prevalent among civilised man.

I have therefore come to you to-night as a humble inquirer after knowledge, and I have endeavoured, I am afraid rather inadequately, to lay before you some of the problems which are perplexing me. I shall be most grateful for any solutions you may offer.

Discussion.

The President said it was evident that the Society took a very wide view of its functions in its study of the subject of orthodontics. A month or two ago they had a most brilliant demonstration from Mrs. Mellanby of the effect of certain dietetic factors in the formation of the jaws. On this present evening they had had the pleasure of hearing a very wide survey of some of the problems connected with the dental arches by an anthropologist. These two papers were two aspects of their study, and the authors of each of them brought a very wide knowledge to bear upon their work. He would ask Mr. Rowlett to open the discussion.

Mr. Rowlett said that he felt very diffident about opening a discussion on a subject which had been so very ably treated by Mr. Buxton as an anthropologist. He would like in the first place to

* This must be considered as a purely relative term.

† Loc. cit.

thank him very much for his exceedingly interesting paper. He wished to look at it from an orthodontist's point of view and to examine in orthodontic terms the facts which Mr. Buxton as an anthropologist had laid before them. The three great questions which the orthodontist had to solve in this connection were : (1) the much-debated question as to what was normal occlusion ; (2) why we had deviated from normal occlusion to-day ; (3) what were the best methods of restoring those dentures which were in malocclusion, and still more of preventing the occurrence of malocclusion. He ventured to say that the anthropologist helped them more in this than in any other particular. What the anthropologist discovered helped them to deduce the etiology of malocclusion. Recently he was conducted by Mr. Buxton through the museum of the Royal College of Surgeons and there he examined the skulls of the Eskimos and the negroids and also the Australian aborigines. The first point that struck him was that in all these primitive races the incisors had an edge-to-edge bite, and that the molars were in what we understood by normal occlusion. It was an interesting point which they attempted to elucidate as to how it came about that the molars were in normal occlusion, and yet the incisors were almost in what he might term Angle's Class III. They thought it might be due in some cases to the large size of the lower canines and in other cases to the very large size of the lower incisors.

The second point was why we had deviated from this normal occlusion and what caused the malocclusions of to-day. This, of course, was an enormous question and one which might fruitfully occupy the Society for many evenings. The first thing to be noticed was the enormous amount of mastication exercised by the jaws of primitive man in the early days. To quote an example from Professor Keith's book, in the case of the Essex woman there was discovered inside the skeleton a little heap making nearly a pint of the seeds of the blackberry and of the dog-rose. That gave one a fairly good idea of the food which these primitive people had, and he thought the greatest cause of all the malocclusion they had to-day was that there was no longer the necessity for the teeth to be in anything like normal occlusion, nor was it important to possess an efficient masticatory apparatus in order that a person might grow up to be an adult. If it was as necessary for us to have comparatively sound teeth in order to exist as it was necessary to have comparatively sound heart and lungs, no doubt the dentures of to-day would compare with the heart and lungs for soundness, but it was not necessary, and therefore the dentures were not sound.

The third point was as to what they could learn from anthropology with regard to treatment. Here, of course, they were faced with an exceedingly difficult problem which brought up the two schools of thought : the American school with the God-given thirty-two teeth, and the other, the compromise school. They would probably go on treating their patients so as to give them an efficient masticatory apparatus and at the same time an æsthetic appearance in the front of the mouth with the very least disturbance possible. He thought that from an examination of these skulls and from seeing the variations which occurred even in them, and also bearing in mind the amenities of civilised life and the extremely soft nature of the foods which they had to deal with to-day, and remembering the further fact that by medical skill and by the amenities and comforts of civilisation a great number of individuals—and consequently dentures—were produced and preserved to-day and were going to grow up into adult life who, in the old times of savage life, when conditions were harder, would not have persisted—in view of all this, he thought there was a strong argument in favour of the compromise school. The jaws they received under their care very often were not capable of being brought into ideal conditions, and he thought they were right in applying an adage of Solon who, after he had made a set of laws for the Athenians, was asked,

'Are these the best laws you can give the Athenians?" and replied, "No, but I think they are the best laws the Athenians can keep."

Professor ARTHUR KEITH said that his first words must be those of congratulation to Mr. Buxton for an interesting paper. He would congratulate him, too, on opening up a subject which was not only of interest to anthropologists and dentists, but to medical men generally. This matter of modern changes in our jaws had been of interest to the speaker, as to the President, for a long time, and in recent years, after very considerable experience, one of the first things he did when a skull was brought to him, if its antiquity was uncertain, was to turn to the palate and teeth, and if he found an overlap between the upper and lower incisors he judged that it was a comparatively recent skull, because in all cases when he was able to date an old skull he had seen nothing but an edge-to-edge bite. It was very rare to find anything but an edge-to-edge bite in a bronze-age man, but now and again one did find the lower incisors coming up behind the upper. In Roman times this was quite common amongst the inhabitants of Britain. Probably half the people of the Roman occupation had the lower incisors coming up behind the upper. When one turned to Saxon graveyards the overlapping disappeared. Our Saxon forefathers had come to England with a robust edge-to-edge bite. When one came down to about Elizabeth's time, overlapping was found to be quite common; and it was for the members of the Society, rather than for himself, to say how many people had an edge-to-edge incisor bite to-day. He would suggest two or three per cent. He only knew one or two people with an edge-to-edge bite, and even in their cases it was not a normal edge-to-edge bite, but an overgrowth of the jaw. There was no doubt, however, that the edge-to-edge bite was the primitive condition. They had to inquire now why this extraordinary change had taken place. The first observation he would direct their attention to—he did not know who made it nor how generally it was known—was that if one applied the incisor teeth edge to edge and then felt the muscles of mastication, it would be found that the temporal muscle was quite out of action, but the moment the finger was placed on the masseter it was discovered that the masseter was hard at work. The masseter was the muscle used in applying the edges of the incisors. With the falling away of the edge-to-edge bite one other remarkable change had come about, namely, the falling in of the cheek-bones. With the falling away of the edge-to-edge bite there was a diminution in strength of the masseter muscle. Another point which he would draw attention to, and which he did not think was generally known, was this: some ten or twelve years ago he was making a comparison between the development of the muscles of mastication—because the anthropology of the face was a study of mastication—in the negro and in the British race in respect to dimensions, and to his surprise he found the British temporal muscle much bigger than in the negro, while on comparing the size of the masseter it was the other way about. He believed our temporal muscle, instead of degenerating, had become rather stronger. We were practically using only our temporal muscle now. Molar mastication was wholly a temporal act; the masseter was hardly used at all. There was a curious kind of evolution going forward so far as the temporal muscles were concerned; these muscles were rather improving than going down. In civilised communities a piece of toast was perhaps the hardest thing most people had to bite off with their incisor teeth. Almost all our diet consisted of soft, mashy food. Meat was indeed eaten, but it was in a soft condition (though recently perhaps tougher than usual). He was under the impression that the chief change which had taken place in our jaws was that the use of the incisors had almost been taken away as a result of the use of knives and forks and the nature of the food consumed. We did not use our front teeth as our ancestors did in order to bite off. That had resulted in a remarkable change in the physiognomy of

peoples. Compare the round-headed, black-haired, round-faced Celt —such as the round-headed Frenchman—who had splendidly developed jaws—with the people who formed the bulk of our nation—the Nordic people, including the Swedes, Danes, and West Germans ; these Nordic people had been the greatest sufferers. It was really a change in diet that was bringing about this change in the teeth, though he was not convinced that it was wholly mechanical, and he suspected that there was something in the nature of the food as well.

A number of minor changes in the face were connected with modern dental and palatal changes, but into these he need not enter. In the molar region he did not think many changes had taken place. Take the wisdom tooth, for example ; we are apt to think that their tendency to reduction is an affair of modern times. If he were entitled to make the deduction from his limited statistics, he would say that one-third of the people who lived in England in Roman times showed absence or retardation of one or more of the wisdom teeth. There was one other point with regard to the overlapping bite which he had not mentioned. What was the cause of it ? Was it the upper incisors that had come forward or the lower incisors that had gone back ? Might not both these changes have happened ? There was a tendency in all modern jaws to be contracted or narrowed. Take the width between the outer margins of the canine as the criterion of the width of the palate, and if the neolithic average be taken as 41-42 mm., the average in modern times showed a diminution of 3 or 4 mm. (to 38 or 39 mm.). The coming together of the canine teeth shot forward the upper incisors a little.

He thought it would be very useful to have statistics with regard to the edge-to-edge bite in children of four years of age. He thought that about fifty per cent. would show the edge-to-edge bite ; at any rate it would be much more frequent than in the adult. One other point to which he might refer was the width from angle to angle of the mandible. That was a racial question to a considerable extent. The Eskimo had enormously wide angles, and the Eskimo was the finest example in the world of masseter mastication ; hence his great cheek-bones. In the R.C.S. museum—as sometimes happened in museums—he found a lower jaw without a history. Its width was quite that of a big Eskimo, but it had not a bit the look of an Eskimo jaw. He came to the conclusion that it belonged to the bronze-age people of France, a very wide-jawed, round-headed people. On going into the matter further he found that our bronze-age people were very wide-faced when measured at the mandibular angle. The bigonial width of the Australian, on the other hand, was comparatively small. Bigonial measurements were certainly worth recording, and the investigation could be carried out in the living with considerable accuracy.

Mr. Rushton believed it to be a fact that the American negro during the last three hundred years had evolved from an edge-to-edge biting negro to an overlapping biting negro. There they were able to see in a comparatively short space of time the change taking place. He had often thought when he had looked at the beautiful specimens of Greek sculpture in the British Museum how very much he would like to see the inside of their mouths. There they saw the human head in its greatest perfection and beauty. One would very much like to see whether the beauty inside was absolutely related to the external features. He did not know whether their anthropological friends could find them any skulls of the period when Greek art was at its best. With regard to the food of the Africans, Dr. Stanley Colyer had lately published a paper in which he discussed this matter, not from the point of view of orthodontics, but from that of dental caries, and he stated that the large majority of the negroes practically ate no hard food at all. Their staple food was a sort of jelly-like porridge which required very little mastication ; and yet, so far as the speaker knew, the facial configuration of these people did not show any lack of muscular develop-

ment. He would like to know whether that point had been come across either by the lecturer or Professor Keith. His own opinion was that the change in the masticating apparatus of the human head had been caused by the progressive diminution chiefly of the mandible. And he did not think that this had come to an end. One of the most frequent irregularities which came before them was one in which the mandible was, as they called it, a unit behind that of the normal bite. One did not know why it came. In his own children the bite of two of them was perfectly normal and regular; the third had this phenomenon. He thought his colleagues would bear him out in saying that this was an extremely common form of irregularity at the present day. He would like to refer to one remark made by Professor Keith, who, in talking about the edge-to-edge bite, said that he had come across edge-to-edge bites which were probably not normal, but due to the overgrowth of the mandible. The speaker thought this was an error. It was not an overgrowth of the mandible, but a deformity that was in question; the mandible was shorter in growth and not longer. They were all very much obliged to Mr. Buxton for his paper. On one point he had left them in doubt, namely, how the modern Berkshire jaw differed from the ancient jaws he found there.

Mr. J. H. Badcock asked when this condition of post-normal occlusion was first seen. Did we begin with the edge-to-edge bite, and then the lower incisors get behind the upper, while now the lower molars were getting behind the upper molars? When was that condition first seen? Was it a phenomenon of very recent years?

Professor Keith said that he had been careful to point out that the development was not entirely mechanical; the nature of the food in the body itself had something to do with it. There was a big element of growth in the case.

Mr. Spokes said that he would like to learn from Mr. Buxton what the food of the Eskimo really was. He was under the impression, derived from the nursery, that they lived largely upon blubber. With regard to excessive wear, he had always understood that, apart from the resistance of the food material, a great deal of earthy matter and sand might be mixed up very intimately with the food material, and if the process of mastication was sufficiently formed, the sand and earthy material would have more to do with wear than the food material. The question of the edge-to-edge bite was one which he had previously discussed with Mr. Rushton. Mr. Rushton had said that the normal articulation of the incisors was an edge-to-edge bite. He (the speaker), on the other hand, declared that at the present time the overlapping was the normal. He belonged to a family of six, and one only had an edge-to-edge bite.

Professor Keith said that it was very interesting that certain teeth should wear into the regular scissors formation. A paper which Mr. D. M. Shaw had written on the shearing action of the teeth threw light on that subject. In the model which Mr. Chapman had passed round earlier in the evening there was a six-year-old molar showing enormously big pyramidal cusps. That was a matter which interested him very much, because the great difference between the gorilla and the chimpanzee was in the form of the cusps. That little child's teeth had a very gorilla-like formation in this respect. There ought to be a definite system of classification for recording the kind of cusps seen among unused molar teeth.

Mr. Rushton pointed out that so far as concerned the wearing down of the teeth it was not necessary to have action of food at all; it could be caused by the interaction of the one set of teeth upon the other.

Mr. Spokes deprecated the use of the word "scissors" to describe the results of wear. It was not properly applicable in these cases. The typical "scissors" articulation was found in the carnivora.

Mr. Rushton said that the term used by Mr. Shaw was "shear" action, which he thought described the condition exactly.

Mr. HAROLD CHAPMAN asked whether there was any evidence of the occlusion of the upper and lower incisors as these teeth erupted. He could only recall to mind one case of edge-to-edge bite in an old person, who was about seventy-five years of age. He imagined that in this instance the person originally had an overlapping bite, but wearing away had reduced it to edge-to-edge.

Mr. NORTHCROFT said that with reference to this shearing bite he thought he was right in suggesting that this shearing off of the buccal cusps of the lower molars and the wearing of the cusps of the upper molars would occur in a mouth where the curve of Spee was very marked with a very extensive lateral movement of the jaw. Probably it was the excessive lateral movement of the jaws which accounted for the exaggerated curve of Spee. It would be interesting to know whether these jaws had that curve very marked.

Mr. BLAABERG suggested that the change which had been taking place in the molars had been a degeneration from vertical development.

Mr. BUXTON, in replying on the discussion, said he was afraid he could not answer all the questions which had been put to him. With regard to Eskimo food, this was almost entirely animal. Blubber was, he believed, the preferred diet, but the Eskimo would eat any form of animal food he could get. There was practically nothing else available. The important point, however, was that they spent a great deal of their time chewing skins to soften them. In speaking as he had done about negro food he was referring to those people of whom he had had experience. A very large number of negro peoples had soft food without, he thought, very much change at all in their dental form. He would like to mention, however, that such little experience as he had had of savage children went to show that their diet was extraordinary. They would eat anything, including beetles and mice. With regard to the term " scissors," he apologised for the use of the word and was prepared to accept the word " shears." The reason why he originally chose " scissors " was because he tried some Eskimo jaws in their action on paper, and he was rather impressed with the very sharp edge they gave. It certainly did cut paper in a scissors fashion. With regard to the question of development in the molar region, he had noticed that there was quite commonly considerable irregularity among the incisors in people who had an edge-to-edge bite, but there was very seldom very much irregularity among the molars. It was quite a common thing among primitive jaws to find this irregularity. Among a lot he had got recently the only dental anomalies were, in one case of crowding, one incisor being pushed right forward out of line, and one canine having failed to erupt. One speaker had asked him the difference between the ancient and modern Berkshire folk. The ancient Berkshire people had this very great wear on the teeth, and the modern Berkshire people had not. The ancient Berkshire people practically never suffered from caries, and he believed this was extremely common among the modern Berkshires. The ancient Berkshire people very commonly suffered from a certain amount of local suppuration which appeared to be due to the fact that, eating what they did, they got a certain amount of dirt mixed in with their food which formed pockets round their teeth.

A vote of thanks was accorded to Mr. Buxton by acclamation and the meeting terminated.

ORDINARY MEETING.

An Ordinary Meeting of the Society was held at 11, Chandos Street, on Monday, March 15th, 1920, Mr. G. G. Campion, President, in the chair.

The Minutes of the previous meeting were read and confirmed.

The following candidates were balloted for and elected :—

Carol P. Lake, L.D.S.Eng., 14, High Street, Windsor.

H. T. A. McKeag, B.Dent.Sc., Dublin, 33, College Gardens, Belfast.

Edward Phillips, L.D.S.Eng., 1, Frognal, N.W.3.

Mr. T. A. Coysh read a paper :

An Expansion Appliance.

When discussing with Mr. Bull the small appliance which is the subject of my communication, it was suggested by him that it would form a suitable Casual Communication for presentation to this Society ; hence my presence here this evening.

The apparatus is one which I practically always use for my expansion cases. In its original form it was a war improvisation for the expansion of jaw cases. At an early stage of that work it was used with some frequency, but it fell into disuse when we went in for immediate reduction with surgical assistance. It was, however, so obviously well adapted for ordinary orthodontic expansion that I have made use of it for that purpose ever since. To save criticism let me say that I claim no originality, though I had not seen it used or described before I made it.

It is composed of tubing, threaded wire with two nuts run on it, exactly the size of the calibre of the tube, and plain wire also exactly fitting. The materials therefore are simple and easily obtainable. The tubing is that made by the Blue Island Company. I use the thick walled exactly fitting the B.A. Standard size screw No. 9. This is convenient, as the screw plates and taps for making the thread and nuts can be obtained without difficulty. At the same time no definite size is essential, providing that it is strong enough not to bend under strain, and those to whom the size indicated does not appeal may find a whole series of taps and dies listed by the Blue Island Company, and from those they may decide upon the size they prefer and choose the tubing, screw plates and taps to fit.

The appliance is constructed by fitting two lengths of tubing across the mouth to be expanded. The upper one is placed exactly where force is intended to be exerted, and the lower one about one-eighth of an inch lower and exactly parallel to it. They can be joined together or treated as separate units. Suitable tags for anchorage in the vulcanite are attached, cribs or other clasps are adjusted, and the appliance is waxed, vulcanised and finished as usual. The clasps are then adjusted to the mouth and the plate is worn undivided for a day or two. It is then cut in two along the mid-line, including the lower tube, but not through the upper

one. This is cut through at a distance of about one-eighth of an inch from one end and a short section of another one-eighth of an inch or three-sixteenths of an inch is removed from the longer portion. This is to give room for the nuts. Into the short end of the upper tube a length of threaded wire is inserted and soft soldered, a piece of plain wire fitting the tube is similarly soldered into the opposite side of the lower tube, any projecting ends are trimmed and made smooth, the nuts are screwed on to the threaded wire, and the appliance is ready for action. One nut is, as you will have gathered, an active one to separate the two halves of the plate, and the other is merely a lock nut. The lower tube and its contained wire act as a guide to ensure parallelism and to give rigidity.

Lately it has been easy to get a fuller supply of the Blue Island appliances, and I have been using, instead of the upper tube arrangement, one of their jack screws with centre nut, lock nut, and right and left hand threaded tubes. This has some advantages over the original form, but it is no more effective. The plain guide tube is of course retained, as the efficiency of the appliance depends on it. The original apparatus is of the utmost simplicity, and has the advantage that almost any amount of expansion can be carried through with it, for, even if it is necessary to begin with a very short length of screw and guide, as the halves separate it is a very simple matter to remove the short pieces and substitute longer to the full available width, and so on as the case advances.

In order to get the utmost possible length, I prefer that the tubes shall be opened through their length. This makes it possible to put in longer wires and facilitates soldering, which is done on to the open end with a soldering iron, and nicely finished afterwards.

I have used this expander with all varieties of appliance, fixed and removable. With an intelligent patient and a removable appliance it is possible to leave it without personal attention for a considerable time. The specimens shown are those of a case worked by the patient during a single term at boarding-school, with very occasional supervision by a colleague in a neighbouring town.

Mr. Badcock said he did not quite understand whether Mr. Coysh soldered his screw in after the plate was vulcanised or not, and whether he found any difficulty with the nut working backwards or whether the lock nut was effective. He would also like to know whether a child could manipulate the nut and the lock nut satisfactorily. With regard to the right and left threaded screw of the Blue Island Co., it seemed to him that that was a disadvantage. He had taken a great deal of trouble to make and use a right and left screw, and found it simply doubled the chance of the screw working backwards.

Mr. Rowlett asked whether it was necessary to cut the thread on the wire with a lathe. No doubt it was exceedingly easy for Mr. Coysh to do it, but he did not think he would be able to do it himself, and he was wondering whether it was possible to do it with an ordinary screw plate.

Mr. Coysh said he always fixed the screw after the plate was vulcanised. Slipping of nuts was a difficulty, but he could only say that if the lock nut was well jambed it was quite effective. With regard to right and left handed threads, he had not found them slip. With regard to whether a child could deal with the appliance, obviously it depended on the child. There were many children he would not trust with it, but now and again one came across a child who could be safely trusted, and in those cases the dentist was saved a good deal of trouble.

The majority of cases he had to treat were permanently under his observation, and the difficulty did not arise with them. The screw was cut by a screw plate. If anyone had a lathe with a split chuck attachment, the wire could be put in the split chuck and the thread cut as the wire was rotated.

Overbite.

A discussion on the subject of Overbite was opened by Mr. J. H. Badcock. The last time there was any discussion on the subject some interesting things were learned about overbite—that overbite of any kind, a normal overbite, was a comparatively recent growth, that in pre-historic man the bite was always edge-to-edge, and it was only since man had taken to the use of a knife and fork that an overbite had developed. Professor Keith mentioned that modern man used his temporal muscles very much more than ancient man, that the temporal muscle was much more developed in the modern than in the ancient, whereas the masseters were less developed. That seemed to be owing to the fact that modern man did most of his biting with his back teeth. He was wondering whether it was this fact of biting chiefly with the back teeth which had caused the condition, which was getting more and more common, of post-normal occlusion. The remedy apparently would be to go back to the habits of primitive man and throw away the knife and fork. In the normal overbite the lower incisor teeth opposed the cingula of the upper incisors, and then came the next stage where the occlusion was normal antero-posteriorly but with an excessive overbite, and the upper incisors instead of overlapping the lower incisors by a third overlapped perhaps the whole length, and the molars were short. It was a condition which seemed to run in families, and was seen now and again in the temporary dentition. He knew one or two families where it occurred, and in those cases the whole of the buccal surfaces of the lower incisors were in contact with the whole of the lingual surfaces of the upper incisors. The next stage was post-normal occlusion, where the lower incisors grew up until they touched something ; it might be the palate far back, and in that case very often there was no point of contact between the lower incisors and the upper incisors. He only knew of three methods of treating overbite of that sort ; there was the method, which used to be widely adopted, of building up some of the teeth, perhaps the temporary molars, to open the jaws and to allow the six-year-old molars to lengthen. It could be done later on, after the temporary teeth had gone, by capping some of the teeth and allowing the others to lengthen, but it seemed to him an unsatisfactory method, because the teeth underneath the cap were being depressed, or at any rate prevented from rising, and when the cap was taken off the whole weight of the jaw came on the few teeth which had newly risen. Moreover that method allowed the lower incisors to grow longer and longer. Then one came to Angle's method of using spring wire arches which depressed the teeth. They were fixed on the molars and passed perhaps underneath hooks which were attached to the premolars and were sprung up and ligatured to the incisors. That method seemed quite good for the lower jaw, but where one was using reciprocal traction, it seemed to him that the shortening of the upper teeth was rather a difficult matter,

because the upper arch tended to be pulled down instead of being pressed up, and if it was fixed in any way to the anterior teeth it tended to elongate them rather than shorten them. The method that seemed to him most successful was that of the biting plate in the upper jaw, which impinged on the lower incisors and them only. That allowed all the back teeth to lengthen together, so that when the plate was taken out the strain was distributed among them all, instead of being taken by one or two. It had the further advantage of depressing the lower incisors. If in conjunction with it an arch was used going round the upper incisors, the tendency, which it otherwise would have, to force them further forward than they already were, was counteracted, and if to that arch little hooks were added which hooked over the incisive edges of the upper teeth, one was able not only to lengthen the back teeth and shorten the lower incisors, but to shorten the upper incisors too. Sometimes he wondered whether the lengthening of the lower incisors and their bite upon the palate close behind the upper incisors, perhaps in contact with them, was not rather exaggerated—whether the lengthening was quite as bad as it seemed.

Mr. Badcock then exhibited a series of slides illustrating a case of post-normal occlusion (Angle's Class II), one side of which was typical of Angle's Div. I, the other side of Div. II.

Looking at the occlusion from the back the difference between the height of the lower incisor on the side where the teeth were sticking out and on the other side was very slight—very much slighter than one would have expected—and that led him to wonder whether, after all, it was always necessary to open the bite before beginning to treat such cases. It had been a routine method with him for many years to do so. Some time ago, during the war, a child came to him with a Class II, Div. I occlusion, a very bad one, and the parents wanted to know what could be done. They said they only had three months available, as they had to go back to Cuba. He told them it was quite impossible to do anything in the time. Eventually it was arranged that if they could promise that the child should remain six months he would do his best. Not only was he limited as to time, but the child was a particularly difficult patient. It was quite obvious there was no time to put in a biting plate for three months, and he had to chance what he could do. It would be noticed that the lower incisors were very crowded and pushed very much backwards. What he did was to take out the two upper premolars and remove a central incisor from the lower. In the upper he put on the apparatus he always used in such cases, bands on the six-year-old molars with tubes, and, sliding through those, a smooth gold arch with hooks to engage over the cutting surfaces of the centrals and laterals, and the usual hooks and elastic bands to make retraction. He fitted pinched bands to the canines in the lower, and to those bands was soldered a small arch which went as far forward as he wished to draw the teeth, and then he drew the remaining three incisors forward by means of a little button made of soft solder, put just behind them and ligatured forward to the arch.

It would be noticed that the spaces in the upper jaw had closed up, the overlap had gone, and the lower incisors were in normal contact with the cingula of the upper incisors. The apparatus

was on about three months altogether. He took it off too soon and the case relapsed to some extent. The patient was still in London, and he might have done the thing in a more elaborate way had he known she was going to stay. He learned two or three things from that case, one being that it was not always necessary to open the bite, another, that if a case were treated without opening the bite, it had to be retained much longer than otherwise would be the case.

The next model showed two cases he had just started to treat by the extraction method and without opening the bite.

Models were shown of these and the preceding cases.

Mr. A. E. Rowlett said the particular form of malocclusion under discussion was exceedingly difficult, because one did not know what the etiology exactly was, and so a scientific, reasoned and logical treatment of the case was difficult, for one did not know what causes one had to deal with. Sometimes he very much envied the American who, with his God-given thirty-two teeth, had only to put on extremely cunning arches and pull everything into normal occlusion, which he supposed it was quite possible to do, although retaining it there was probably much more difficult! He had been extremely interested in the case Mr. Badcock showed and also in the practical points on which he spoke. After all, in the treatment of such cases one had to bear in mind the main objects to be attained. The first thing was an efficient masticatory apparatus, and the second thing, especially in girls, was to get a pleasing effect in the front of the mouth, and the third thing was that the operations should be carried out with as little pain and discomfort to the patients as possible. It was a very difficult thing to speak about, especially in the presence of specialists in the art, but if the ordinary general practitioner bore those three points in mind it would be of great benefit. As to treatment by extraction, which he practised rather freely, largely owing to Mr. Badcock's teaching and example, he always asked himself the question: Is this case an acquired case or is it a case of heredity? As Mr. Badcock had pointed out, the cases were found running in families, the same deformity showing itself in different ages in the same family from grandfather to children. Extraction very often shortened the treatment. He was interested to hear about the treatment without a biting plate of the lower incisors impinging upon the palate. He had obtained his best results in the same way as Mr. Badcock described, by expansion at about the age of eight, and at the age of ten extraction of the first premolars and retraction of the incisors by the arch with a smooth-fitting band and loops over the incisors. The only cases he had done with the Angle appliances and the reciprocal traction in trying to move all the teeth back had certainly been very pleasing and satisfactory to the parents, but he did not know the patients' opinions. He was inclined to think, after his own experience in the provinces, that for the general practitioner the expansion of the arches and extraction of the premolars and retraction of the incisors was by far the most satisfactory method.

Mr. H. E. Marsh exhibited models of a boy aged four years and nine months, which showed considerable overbite and the lower jaw in post-normal occlusion. He asked the members to consider whether that might not be the result of an illness. Up to the age of three he was a perfectly healthy boy, breast-fed and fully developed, and up to the age of three he had normal occlusion. At three years and three months he was taken ill with a very severe attack of infective gastro-enteritis which confined him to bed for six weeks, and for six months he never masticated anything at all. He lay in bed night and day with his mouth open and his tongue covered with sordes. The treatment necessitated his being fed only on a little brandy and quantities of water

containing white of egg. When he began to get well he had pre-digested liquid food. At the end of six months his lower jaw began to drop back, and the speaker ventured to suggest that was a case where that condition of post-normal occlusion might have been brought about by the general lowering of the child's vitality and the lack of functioning of his masticating muscles. He had been fed from the age of two and a half to the time he was taken ill almost entirely on the Sim Wallace system of diet.

Mr. Marsh showed another case of post-normal occlusion. He could not say for what reason the lower jaw dropped back, but it was half a unit post-normal and there was a great deal of crowding in the lower incisor region and the lower teeth bit on the palate more than half an inch behind the cingula of the upper incisors.

He showed another case five years after the retention was taken off and the bite had been successfully jumped and had remained jumped. The treatment consisted in the wearing of one of Mr. Badcock's types of plate with a little arch in front and U-shaped loops in it, and extending the lower jaw by means of an Angle arch with nuts in front of the D-band and the lower incisors attached to it. He put retention on nine months after treatment was started and kept it on for eighteen months. It broke two or three times and had to be re-done. He took it off at the beginning of 1915 and saw the case again about a fortnight ago, when he took the models. The retention consisted of plain bands on the upper molars, on the upper premolars, and on the upper centrals, with a gold wire soldered to the molar and premolar bands and little clips on the incisors which the arch was engaged in. In the lower jaw it consisted of plain bands on the lower molars with a lingual arch. It would be noticed that the lower right first molar was outside the arch in the finished case and also that there was still a good deal of fan-tail.

Mr. Marsh showed a fourth case, one which he said had been more or less a failure. The arches were contracted, the patient biting right into the palate, bruising the mucous membrane. It was a Class I case with superior protrusion. The case was treated with Baker bands. Badcock expansion plates were used first of all and afterwards Baker bands to move the lower jaw forward, and it would be noticed that the inter-digitation of the teeth was very poor when the case was finished. The child was a very difficult one to deal with, breaking apparatus and not reporting it. The retention was kept on for only nine months and then it broke and the child kept away, and within three months the teeth went back and the work had to be done all over again. He had tried removable retention appliances, but in his hands they had been failures.

The fifth case was a very bad one of superior protrusion and inferior retrusion. The lip was right underneath the upper teeth, and when the models were taken they showed that with the boy's mouth closed the lips closed about one-third of the upper incisor teeth. The canines were just about to erupt, and pushed the roots of the lower incisors together and lifted four of them right up and produced the fan-tail appearance. He decided to extract the lower right central and the upper first premolars, and, having done that, he put on Baker ligatures and within two months produced the condition shown in the next model. The case emphasised what Mr. Badcock said about the lengthening of the upper incisors when Baker ligatures were used. When the boy's mouth was closed now, although the upper incisors were pretty nearly vertical, nearly the whole of the upper incisors could be seen, and it was rather distressing. The case had been under treatment for about two and a half months, and he hoped ultimately to make some improvement.

The PRESIDENT showed some drawings of a case. The treatment was the removal of the first premolars and the use of a similar arrangement to that which Mr. Badcock had described, the old Angle appliance,

the arch being pulled back by elastics. The next slide showed the result. There was a little place left on the left-hand side which had not come quite back, but the upper and lower incisors were in excellent occlusion. The lowers were no longer biting on the gum but on the cingula of the upper teeth. There had been no raising of the bite and no deliberate expansion, and practically no retention except at night. One of the factors in maintaining and increasing the abnormality was lip pressure between the upper and lower incisors, and if that could be eliminated the lips helped in retention. The child was at a boarding-school and he could only see her in the holidays. She was under treatment for three terms, and in one term something went wrong and she was brought to him, but in the other two terms he did not see her. She came to him at the end of one term on her way home, and the teeth were retracted enough, but in quite irregular positions owing to the inevitable lack of supervision. He took off every bit of apparatus and made her a little retainer, which was worn at night only with a cap. If one imagined the front part of an ordinary impression tray, the vertical piece of metal curved to approximately the arch, and then a flat piece soldered to that, to catch the incisor edges, and a couple of wires which came to the centre of the mouth and bent backwards and were attached by elastic to an occipital cap, one would have an idea of what the retainer was. This was worn only at night with the happiest results. There was no retention in the day-time. At the end of the holidays the teeth were in excellent position, with the lower incisors biting on the cingula of the uppers. The amount of retention at night had proved to be ample. To him the discussion had been of absorbing interest. He would like to ask Mr. Coysh, in connection with the models of expansion he had shown, what was the position of the articulating surfaces of the molar teeth. His experience was that in cases of Class II one had to deal almost invariably with lower molars which were tilted inwards, and he would like to know whether that was one of the factors which went to the production of what was called a " close bite." In perfectly normal arches he was inclined to think that the lower molar had, if anything, its lingual cusps a little higher than the buccal cusps. In the lower second molar, unquestionably, there was a tilt inwards of the masticating surfaces, and almost without exception he thought it would be found that the buccal cusps of the second lower molars were higher than the lingual cusps. He was very much interested in what Mr. Badcock and others had said about raising the bite. In his hands the biting plate had often been quite ineffective : he had got the bite raised but it had slipped back again, even though he had made the patients wear the plates for quite a long time.

Mr. Carl Schelling said he had some patients who came to London only every year or two and wanted something done, and in those cases he had made a biting plate and had carefully estimated the amount of raising intended, and the simple method was to do this by putting a wooden match into the composition and getting the patient to bite into that. The plate was then fitted in and cut away so that it did not impinge on the palatal surface of the upper incisor teeth, and the patient in some cases had not come back for two years. In several cases parents had been pleased with the result and did not require anything else to be done, the upgrowth of the molars having kept the lower incisor teeth from biting upon the upper incisors, so allowing the anterior teeth to fall back, presumably from the pressure of the strained lip.

Mr. Cale-Matthews said the etiology of the subject had little or no interest in one sense. It was almost impossible to establish the facts, because the patients came when in the majority of cases those facts were already established. Also extraction had little or no interest to him, and he could not speak on that side of the subject. A point which had not been touched upon was the facial aspect of the patient both after correction and before correction, and to him that was the

most important point that had to be considered when function was restored. Primarily, function was the thing to be restored, and, having restored that, the profile and appearance of the patient were the most important thing. Approximation to correct occlusion would very easily give some of the causes of the trouble. In many of the models and slides shown that evening the post-normal cases were held in position by the narrowness of development across the canine region. His own experience had proved to him conclusively that the widening of the canine region would relieve the difficulties in many cases and would restore a contour to the profile that could not be got by adopting the easy method of extraction and reduction. He went so far as to say that the majority of superior protrusion cases were not superior protrusion at all ; as far as the maxilla was concerned they were normal. The development of the mandible would soon convince anyone that the upper part of the face was correct. There might be protrusion of the individual teeth, but post-normal occlusion was entirely due to the lack of development of the mandible. The overbite was due to the post-normal occlusion and lack of development in the ascending ramus of the jaw, or what he preferred to think a lack of development of the alveolus. The lengthening of teeth was spoken of in an extremely loose manner. Teeth were only the length of themselves. Long teeth or short teeth were developed beyond the gum margins the length of themselves, and whether they had the appearance of being long or short must largely depend on their inclination. That was shown in one or two of the slides, in which the teeth were very prominent, but when reduced to the vertical position they were very much more visible. That was perfectly obvious, because there was not the posterior development in the molar region. In nearly the whole of the models shown that evening the curve was exaggerated. If treatment were adopted that would reduce the mandible to normal occlusion and normal growth was allowed, he thought the difficulties would disappear very rapidly. In hospital practice where one had not the opportunity of following cases day by day, one was astonished to see the results which came about by following instructions after a short diagnosis. He was fast coming to the conclusion that in the treatment of irregularities if one adopted a broad outline of beauty, function and occlusion, and left the individual teeth more or less to take care of themselves, one's struggles were very much reduced. Apparatus was a matter very much of individual ingenuity, and he preferred personally to avoid anything that had any tendency to interfere with function. He avoided the biting plate, and he said that with all due deference to Mr. Badcock and with all gratitude for the help he had received from him. The hook over the arch he used years ago he had abandoned, as it interfered with the natural function of the teeth, and it had to be borne in mind that right throughout the treatment it was necessary to allow everything possible for the natural function to take place. He was deeply grateful to those who had brought the cases forward that evening and was pleased to see that they were all working towards the same end, but he did appeal to the members to have one purpose in view. Mr. Rowlett's work was very thorough and beautiful, but provincial men had not the opportunities of men in town ; they had not opportunities of consultation one with another, and it was very helpful to come to a meeting such as the present one and hear the opinions of various men. If the same results were reached by different roads, well and good, but his own feeling was that the simpler the methods adopted and the smaller the interference with function, the more helpful was the work to the patients and the less trouble to the dentists themselves.

Mr. GEORGE NORTHCROFT thanked Mr. Cale-Matthews for having expressed so tersely his own opinions, with the exception of the use of the biting plate. He thought the question of the tilting of molars could be put aside, because he had many cases of marked overbite of Class II, Division I and Division II, in the temporary dentition before

the first permanent molars had erupted at all, so that evidently it had nothing to do with the tilting of the permanent molars. He was extremely interested to hear Mr. Cale-Matthews bring up his old hobby of the canines, because that was becoming like King Charles's head to him. He always brought up the bite of convenience, which he was sure produced a very large number of post-normal occlusions, and if the upper temporary canines were expanded a great many cases of post-normal occlusions would be got rid of quite normally. He would ask the members in future, if they could be persuaded to do so, to use a little more advanced nomenclature than they were in the habit of using in the Society. It was time to abandon the use of men's names, such as the "Baker anchorage," and call it "inter-maxillary traction." Also it was time to abandon "Class I" and "Class II" of the Angle classification and adopt the nomenclature which spoke of "antero-occlusion," "distal occlusion," and "mesial occlusion," things which expressed in words what Class I and Class II did in a clumsy way.

Mr. J. H. Badcock said that Mr. Marsh's case, where he thought the post-normal occlusion was the result of the child being ill and lying on its back for a long time with its mouth open, was very interesting. The models showed the case to be normal occlusion, although Mr. Marsh said it was post-normal occlusion. He had looked at the models since and he found that on one side there was definite post-normal occlusion and on the other not quite so much so. Mr. Marsh said that he was certain the occlusion was normal and that the change did take place. He had always been somewhat sceptical of the post-normal occlusion being acquired. He thought he could trace its origin from the beginning when he could go back far enough, but it was possible he was wrong. With regard to the lengthening of the upper incisors by the drawing down of the arch with inter-maxillary traction, it was possible to shorten the centrals to any extent and at the same time get a satisfactory anchorage on the molars. Mr. Campion had found the biting plate not to be a success, and he would like to know whether he used a biting plate pure and simple without a wire in front.

The President said it was quite successful in raising the bite, but when taken out the bite dropped again.

Mr. Badcock said that raising the bite was generally a preliminary to doing something else. With regard to Mr. Schelling's remarks on the case which was post-normal and became much improved, if a biting plate was put in, the jaws would slip forward and be held forward. He used that fact a long time ago, and hoped thereby to be able to jump the bite by means of an inclined plane in front of the mouth. He found that the lower came forward all right but never stayed there. He wished to express his great admiration for Mr. Cale-Matthews' work, which was absolutely first-rate. He agreed with Mr. Cale-Matthews and Mr. Northcroft that function and beauty were the two things to aim at, and he would not very much mind if he could get a series of patients to put beside those of Mr. Northcroft and Mr. Matthews to be judged on those two points. Curiously enough, no one mentioned the treatment of excessive overbite, which was the thing he had asked about in opening the discussion.

A vote of thanks to Mr. Coysh and Mr. Badcock for their communications concluded the meeting.

ORDINARY MEETING.

An Ordinary Meeting of the Society was held at 11, Chandos Street, Cavendish Square, W., on Monday, October 18th, 1920, Mr. G. C. Campion, President, in the chair.

The Minutes of the last meeting were read and confirmed.

Several new members were welcomed by the President, and formally admitted to membership.

Mr. A. Garrow, L.D.S.Edin., of 29, Queen Anne Street, W.1, was ballotted for and elected.

Mr. W. Warwick James explained the construction of

The Anti-Mouth-Breathing Valve: An Improvement.

Some years ago I read a paper describing an apparatus made of a wire frame over which a rubber dam was stretched, put in between the lips and cheeks and gums and teeth in order to prevent mouth-breathing at night. At the time I felt it was an imperfect apparatus and at the end of my paper I said that it could be improved upon. Mr. Northcroft afterwards described one he made of aluminium. For a time we tried to experiment with rubber to see if we could get a soft rubber valve. I say "we" because Mr. Jones did all the experimenting and I only made suggestions. In due course he found that the best form of rubber to use was the soft rubber that was used formerly to line dentures where the mouth wanted gentle treatment. We found that rubber answered our purpose.

(Models were shown by the epidiascope and explained by Mr. James.)

I generally take the impression with composition, rolling up as formerly described.

The first slide I show is a piece of vulcanite soft rubber as completed. It goes back as far as the molar. It is necessary to be careful not to get it far enough back to rub—that is the difficulty with these forms of valves. Soft rubber valves being more flexible have an advantage in that they are less likely to rub—perhaps it is the only advantage.

Having got the impression and a model made, a quite thin layer of wax is put on in order to take out the different irregularities of the surface. Then with zinc and lead in the ordinary way, two layers of tin are struck up; each is sufficiently stiff not to bend easily. Then between the two struck tins another layer of wax of the ordinary thickness of pink wax is inserted. When that is ready it is invested in the ordinary way, and the wax is removed and rubber is placed in between and the tin gives the necessary smooth surface to the rubber. Such a surface is rather difficult to get. Specially prepared rubber that is thinner than the ordinary rubber is used. The thin rubber is so prepared in order that in packing a piece of an ordinary dental napkin can be inserted between two

layers of it. When cleaning the valve, patients are apt to pull on them, and there is always a V corresponding to the frænum and they are apt to tear it there. I suggested that we should try putting some fibre of some sort in, and we experimented with one or two things, but we found the dental napkin cut up answered our purpose excellently. The rubber can be vulcanised in the ordinary manner. On being removed from the flask the rubber which has squeezed out through the edges of the tin has to be cut away with scissors, and in order to get it smooth it is treated with chloroform on wool.

Discussion.

The President thought that most of the members had used such valves. Personally he had used the form which Mr. Northcroft introduced, the aluminium one. He would like to ask Mr. James whether he had any difficulty owing to the size of the valves, whether the saliva from the parotid duct came dribbling out of the mouth. That was a point that he had kept his eye upon sometimes and he would like to know whether there had been any complaint of that kind in Mr. James's experience.

Mr. Lewin Payne thanked the author for the work he had done on the subject. One method which he had himself adopted was to employ the ordinary hard vulcanite for the main portion of the valve, thickening up the edge of the valve when it was first moulded in wax, and when vulcanising he packed just the border with soft rubber, vulcanising the whole together. In that way he was able to employ a valve which was sufficiently thin yet strong, and he thought quite as comfortably worn by the patient as one made of soft rubber throughout.

Mr. George Northcroft said he wished to disclaim all idea of being the originator of the aluminium valve, as he understood that Mr. James had made one at the same time he introduced his soft rubber valve. He differed a little in his technique in making the valves. He took upper and lower models and articulated them, and then slightly opened the models, because the mouth at rest during sleep was always slightly relaxed, and he thought a more perfect valve could be obtained in that way. He had noticed a certain amount of salivation from the wearing of the valves, but found in many cases that that disappeared after a valve had been worn for a little time. He thought Mr. Payne's suggestion of a soft rubber edge was a very good one where it was thought desirable to use rubber, but he believed in the valves being worn for a considerable time, and thought that soft rubber must become unpleasant to use after it had been worn, say, three months.

Mr. Pitts said that when Mr. James read his first paper it had struck him that mouth-breathing was a habit. If there were any nasal obstruction it was obvious that a valve could not be worn. He wondered whether the wearing of the valve would cause that habit to cease, or whether, if the valve was left off after a time, the patient would be still a mouth-breather. It would be interesting to know whether the habit still persisted and could be only checked by the constant use of the anti-mouth breathing valve.

Mr. Badcock said there were some people who had nasal obstruction to a certain amount but not complete; he was one of those persons. By wearing one of the valves he was very much more comfortable in the morning; his mouth was not dry and his tongue did not cleave to the palate as it did when he did not wear the valve. The valve was useful in cases of partial obstruction. He thought there were a great many people like himself who could breathe quite freely in certain positions. With the head upright he could breathe easily, but lying on his side breathing became blocked. He found the dribbling nuisance did not cease with the length of wear. He would

ike to ask Mr. James whether he did not think he lost something by the non-rigidity of his valve, because it was useful not only for preventing mouth-breathing but as a retainer in case of prominent teeth, and if it had any influence on the teeth it seemed to him it would be better that it should be rigid.

Mr. W. J. MAY said there were some children who could breathe through their nose, but when they threw their heads far back in their sleep they breathed through the mouth. Was there any objection or disadvantage in having a skull and chin strap arrangement, so that they could not open their teeth at night except to a slight degree, their lips remaining closed ?

Mr. WARWICK JAMES in reply, said with regard to the President's remark about dribbling there was no doubt that when the apparatus was first introduced into the mouth it did cause very considerable dribbling and added to the dribbling that already existed. The majority of mouth-breathers dribbled at night—there would be a slight trace of saliva upon the pillow—and some very considerably. The introduction of the apparatus increased that dribbling. He thought it depended very much upon the patient and on the degree of the condition. It could be improved. If he found mouth-breathing he tried first to check it without an apparatus. He had made use of tying up the head. He told the patients that before they went to sleep they should put the tongue against the roof of the mouth, close the teeth and swallow, and that if they got in the habit of doing that the teeth would remain closed. He had found that with a few people that was of very great advantage, and it was undoubtedly helpful to people who were wearing an apparatus. On that account he did not adopt the method of the teeth being kept apart when taking the impression. It made it easier for them to bring the lips together, which was a factor of considerable importance if the cessation of mouth-breathing was ultimately to be brought about. He thought Mr. Lewin Payne's suggestion of making a rigid vulcanite valve with soft rubber edges might be useful. The real difficulty with the rubber was to get a good surface. With a bad surface the rubber did become somewhat sodden. With a good surface, such as was generally obtained, the rubber was cleansed and kept really clean. The apparatus was worn at most only a third of the twenty-four hours, and he always directed his patients to keep it in water between times, so that the rubber did not tend to dry. Although he did not tell them to use any antiseptic, he told them to put the apparatus occasionally into some weak antiseptic and keep it thoroughly clean. Rubber solvent must be avoided. With regard to Mr. May's remarks, mouth-breathers always suffered from gingivitis, which might go on to a much worse condition. If the treatment was undertaken of an infected mouth where mouth-breathing existed there would be almost certain failure unless the mouth-breathing was arrested. One of the patients whose models he had shown was an obvious mouth-breather, but she was a very determined woman who forced herself to breathe through her nose in the day time. She had worn an apparatus now for some time, and the condition of the mouth had very considerably improved. The gingivitis was bad, so much so that he thought at one time he would have to remove the incisors, but the condition had so improved, from the wearing of the apparatus at night and her control during the day, that he thought her teeth might be retained for a considerable period. He did not think there was any greater benefit to be derived from the apparatus than the arrest of infection in the mouth. Reference had been made to the use of the apparatus for bringing pressure to bear on incisors that were protruding and had sufficient space into which they could be pushed back. Mr. Northcroft himself really designed an apparatus which was original. He uses an apparatus of aluminium, cutting a slot on each side from which to stretch the rubber dam so as to bring pressure on to the incisors. If the

rubber were too taut the teeth become tender, and the apparatus rocks across the front of the teeth. Really only a slight pressure was needed. He found that slots cut on each side of the aluminium answered the purpose better. If one wanted to bring pressure by the soft rubber valves, it was easy to do so by scraping the surface of the teeth on the model upon which pressure had to be brought. With regard to the head being thrown back, it was a most important thing that a child should not lie on its back. A great many mouth-breathers tended to lie on their backs, and in that way the head was thrown back and the jaw dropped very easily. He had gone so far as to use strapping for the lips for a period, and in some cases it had been effective but it needed a very careful mother to deal with it, because the strapping tended to make the face sore. If a child was amenable to treatment they would often assist in the work. They were given directions to swallow with the tongue fixed on the palate. There was undoubtedly a great deal to be gained by bringing the lips together. A rubber valve was not needed if the lips were brought together, and it might be possible to arrest mouth-breathing by that method alone. With reference to nasal obstruction, there were no doubt some people whose noses were so obstructed that mouth-breathing was inevitable. Also a certain number of people would not persist in any form of treatment; they had been going on for so many years in the same manner that they were satisfied to continue. The nose improved very considerably if mouth-breathing could be arrested. The nose physiologically supplied a certain amount of moisture to be taken up by the air in respiration, and if the air passed through the mouth it took up moisture from the mouth but not to the same extent as it did from the nose. The nose became filled with a stagnant secretion which accumulated, children suffering in this manner could be recognised going about with mucus running down. With that stagnation catarrh nearly always followed, because the fluid became infected. He himself thought that adenoids in many cases were actually due to that, but that was a matter that required investigation and perhaps he ought not to make such a bold statement. Certainly the fluid was actually secreted in the nose, and if it was not taken away the catarrhal condition increased and air passed much less readily through the nose. If at night, by means of an apparatus, and in the day by the patient's effort, mouth-breathing was checked, the nose became more functional, the air passages became clearer, and people who were formerly unable to breathe through the nose freely could do so quite readily. He had one patient who had the greatest difficulty in breathing through her nose. Her husband was a medical man and rather scoffed at the idea of establishing a free airway through the nose, but she was now on the spirometer able to beat her husband in the amount of air she could pass through the nose. In a case of partial obstruction, if the patient was a good patient it was almost always possible to get a good result. In conclusion, he wished to express his thanks to Mr. Jones, who had really done all the practical work on the apparatus, and had achieved something that was really of use.

Mr. Northcroft thought that the following casual communication might be of interest to orthodontists, as it establishes what is believed to be a new principle in the design of splints preparatory to the resection of a mandible. Recognising the amount of vibration when using a bone saw as usually supplied, and knowing that provision for the use of an Albee saw is not made in a great many nursing home theatres, it saved all the wrenching to which splints are so often subjected if they were split first and joined afterwards. The splint now shown is from an actual case. There was no lesion of the mucous membrane or surface epithelium, but when sections were made of the tumour it was found to be a squamous epithelioma. The idea of the splint is that it is a combination of struck metal splint and bands. A band goes round the two second premolars in the form of an Attelle and

screws up tight below the largest circumference of these teeth, so that the splint is held firmly in place as well as being cemented to the teeth. In this case the eight front teeth were removed previously to the major operation as being involved in the disease, and then the splint was constructed and set, the screws joining the two halves were then removed, so that at the time of operation the vibration of the saw would not jar either side of the splint in any way, and the splint would be held firmly in position. The upper splints were also cemented on to the teeth and immobilisation secured after the patient recovered from the anæsthetic. A new principle in the construction of these splints is established, which I trust will prove of future value to all dental surgeons who have the misfortune to help in the treatment of these difficult and painful cases.

X-rays and microphotographs were shown illustrating the case.

The PRESIDENT congratulated Mr. Northcroft on the splint and the convenience of it. He presumed that the two halves were connected by wire.

Mr. NORTHCROFT said they screwed together.

The PRESIDENT asked whether the connecting bar was removable when the operation was done.

Mr. NORTHCROFT said that only the two screws were removed at the time of operation and were replaced after the bone was resected, so that the two parts could be moved separately from one another. In that way all the vibration was taken up, so that the splint was not jarred off when the operation was being performed. Very often a surgeon had to take a pair of bone forceps and cut through the whole mass, which jarred the setting of the splint tremendously.

Mr. WARWICK JAMES said that in the Middlesex Hospital there was a large number of cases of malignant disease of the mouth, the tongue particularly, but he was not sure that he had ever seen a case of squamous carcinoma having arisen on the gum margin or on the surface of the epithelium. The number of carcinoma cases that had been described as burrowing epithelioma had occurred in the maxilla, and they seemed very curious in type. The older operators removed some of them by merely scraping the tissue. Under the microscope it looked like carcinoma but the cases did not all recur. Among the more recently recorded cases there was one at the Charing Cross Hospital which seemed to be a type of burrowing epithelioma, but he did not know that one had been described as occurring in the mandible, and it looked very much as if Mr. Northcroft's case was one of that sort. With regard to the treatment when malignant disease occurred in the mouth, it had become the custom at his hospital to remove all the teeth in the mouth. It was a very drastic procedure, because it was a very great loss to the patient. They might not be removed all at one time, but if the decision rested with him he removed the molars, especially in a case in which the tongue was involved. The thing was to get the mouth as clean as possible for the operation, and if teeth remained in the mouth for a period following the operation they were bound to become dirty and the wound was much more likely to become septic. Teeth were of great importance, but in the case of malignant disease the life of the patient was the prime consideration, and it was necessary to do the best possible for him after the teeth had been removed. He was not only speaking of the removal of teeth for the purpose of operative procedure, but the fixation of the jaw that followed led to very distressing symptoms indeed. With an unhealthy mouth that was bound to follow. The nurses at the Middlesex Hospital told him that if the teeth were absent they could keep the mouth clean and the man's condition remained a happier one for a very much longer period. It did not happen to everyone to come across a great number of such cases, and if any member should come across such a case he would like him to remember the experience at the Middlesex because the comfort added to the man for the time he might have to live was

very considerable. His remarks did not really apply to Mr. Northcroft's case, but he had been mentioning the matters privately to him and thought they might be of general interest.

Mr. NORTHCROFT in reply, said that he had been always accustomed in cases of epithelioma of the tongue, or of any obvious cancerous condition of the mucous membrane of the mouth, to remove all the teeth. At the London Hospital it was done as a routine thing, and whatever happened to the patient's jaws afterwards was more or less left to chance. In the case he had mentioned they were faced with a very difficult problem. There was doubt about the malignancy of the growth. The surgeon was anxious that something should be done at once. It was only after pressure that he was allowed to take out the eight front teeth. They were not sure until the man was on the table whether the condition was malignant or not. There was no visible lesion at all. There was a slight swelling on the floor of the mouth, which could be felt with the finger, and a slight external tenderness. He made provision for irrigation and oral cleanliness as far as was in his power. He knew perfectly well the great importance of keeping the mouth as clean as possible, but under the circumstances he thought perhaps other men would have acted in the same way as he did.

The PRESIDENT thanked the readers of communications and those who had taken part in the discussion, and adjourned the meeting to November 15th, when he said a number of patients would be produced for diagnosing different types of cases, and the discussion of treatment.

ORDINARY MEETING.

An ordinary meeting of the Society was held at 11, Chandos Street, Cavendish Square, on Monday, November 15th, 1920, Mr. Campion President, in the Chair.

Casual Communication.

An Adjustable Band for Molar Teeth.

Mr. Cale Matthews thought it was within everyone's knowledge what difficulty and loss of time there were in making molar bands, to cement on a tooth, from the tooth itself. He always felt that an adjustable band was wanted for that purpose, and he had lately been using one that he hoped was going to fulfil the requirements. It was an ordinary overlapping molar band fastening on the buccal side of the tooth. A fairly thick piece of half-round wire was cemented on the buccal side of the band and tapped. The one piece was threaded and the other plain. An ordinary square-headed screw was used, turned with the key of the Lennox matrix. Being a half-round wire nothing could scratch the cheek and it was possible to utilise the end of the screw for intermaxillary traction, turning it back against a tooth, and, with a little experience, it was possible to approximate the soldering of the pieces so that they would close when the band was in position. The whole thing could be fixed in a few minutes, as in the case of the ordinary adjustable band, and was removable for cleansing purposes, and any of the attachments could be soldered to the lingual side. There was also room above the threaded portion to solder an horizontal tube on if wished. The wire did not need to be more than one sixteenth of an inch, as it was strong and rigid.

(Diagrams were shown illustrating the communication.)

Mr. Chapman asked whether there was any difficulty in putting on the nut, seeing that the screw would lie so very close to the band on the tooth.

Mr. Cale Matthews said it did not lie so close as to be affected in that way.

Clinical Evening.

Five patients in need of orthodontic treatment were shown and examined by the members, and a discussion on their diagnosis and treatment in which the President and Mr. C. S. Morris, Mr. Steadman, Mr. Rushton, Mr. Meyer, Mr. C. Matthews, Mr. M.Stephens, Mr. Highton, Mr. H. Chapman, Mr. C. Schelling, Mr. Green, and Dr. Sim Wallace took part, but as no one was present to describe the treatment actually adopted or the results obtained the discussion is not recorded in these transactions.

The meeting then terminated.

ANNUAL GENERAL MEETING.

THE annual general meeting of the Society was held at 11, Chandos Street, Cavendish Square, W., on Monday, December 6th, 1920, Mr. P. SIDNEY SPOKES in the Chair.

The Minutes of the last meeting were read and confirmed.

The CHAIRMAN explained that he had been asked, as a Vice-President; to take the Chair that evening, owing to Mr. Campion having had an attack of influenza and his doctor not allowing him to leave home.

The HON. SECRETARY read a telegram from Mr. Campion : "Best wishes for meeting to new president and for new session."

Mr. F. N. Doubleday, L.R.C.P., M.R.C.S., L.D.S.Eng., of London, and M. Sylvain Dreyfus, Medecin Dentiste (Geneve), of Berne, Switzerland, were duly elected members of the Society.

The following officers and councillors were elected : President, Mr. J. Lewin Payne ; Immediate Past President, Mr. G. G. Campion ; Vice-Presidents, Mr. W. W. James, Mr. P. Sidney Spokes, Mr. Sheldon Friel ; Secretary, Mr. Harold Chapman ; Treasurer, Mr. H. C. Highton ; Curator, Mr. B. Maxwell Stephens ; Librarian, Mr. Bertram B. Samuel ; Editor, Mr. Carl Schelling ; Councillors, Mr. A. H. Clogg, Mr. C. F. Cale-Matthews, Mr. A. T. Pitts.

Papers were read by Mr. J. W. Mayer, Mr. C. S. Morris, Mr. A. T. Pitts.

A Case of Inferior Protrusion in the Deciduous Dentition.

BY Mr. A. T. PITTS.

The patient, a girl of five and a half, attended at the Hospital for Sick Children in January of this year when the deciduous molars were removed on account of caries. Unfortunately the occlusion was not noticed for there was no reference to it on the patient's card. She next attended in October and it was then seen that she had inferior protrusion, the lower incisors and canines biting well outside the upper teeth, so that when the jaw was closed there was a marked overbite. The upper first permanent molars were present and the lower molars just commencing to erupt. Impressions and bite were taken. I saw the child again last week : the lower permanent molars are present though only partly erupted and are slightly tilted ; some of the lower incisors have been shed but the bite remains the same. It might be argued that the fact that this unusual condition was not noticed at the first visit indicates that it was not then present and that it subsequently developed as a bite of accommodation on the loss of the lower molars. There are two arguments against this : the first is that if inferior protrusion does occur as a result of the premature loss of the deciduous molars, I should certainly have seen a good many cases, for I have been compelled on many occasions to remove all the deciduous molars previous to the eruption of the permanent molars, but I have never seen inferior protrusion develop as a result. The second

argument which is more conclusive is that in this case there is a notable lack of attrition in the incisors and canines. In a normal child of six there should be marked attrition of the incisors, especially the maxillary incisors, which may have the whole of the overlap obliterated. This is due to the fact that in children a sliding movement forward of the mandible is an important part of the movements of the jaw in mastication. The fact that this is absent in this case warrants us in concluding that the condition of inferior protrusion has always been present.

The history was not very instructive; there were two other children; in one of them the mother stated that the bite was edge-to-edge. She herself had had an edge-to-edge bite but as she is now edentulous this could not be confirmed and it is possible that her memory is at fault. The mother had never noticed the abnormal occlusion in this child until I pointed it out. The birth of the child seems to have been normal so far as the presentation was concerned, although prolonged; forceps were not used, and the mother did not notice any undue moulding after birth. The child had suffered from adenoids which caused her to sleep with the mouth open and to snore. These have been removed. The appearance of the child and the shape of the maxillary arch do not indicate any defective development of the maxilla. The child was breast fed, no comforter was used and there was no history of any habit such as thumb-sucking.

Except for a very doubtful history of heredity there is no clue to the etiology of this condition.

A few cases of inferior protrusion appear to be caused by habits; others may be due to influences acting at birth; while in another group the inferior protrusion is only relative, the actual factor being the defective development of the maxilla. By far the largest number remain unaccounted for by any of these causes and, except that in many of them there is a very definite history of heredity, we are without any clue as to their etiology.

I would suggest with some diffidence that inferior protrusion might be regarded as a kind of reversion to type, the reversion taking the form of an over-emphasis of the tendency, habitual in children, to an edge-to-edge bite. We know that the bite of primitive man was edge-to-edge and that the same condition is found to-day in certain races. According to Prof. Keith the occlusion commonly found in the modern European is of comparatively recent origin and he suggests that it may be due to the introduction of the knife and fork. He also said that if this were so we might expect to find an edge-to-edge bite commoner in children. An anatomical edge-to-edge bite (that is to say, when the jaws are at rest and the condyles are in almost their most posterior position the front teeth meet) is distinctly uncommon in children; a functional edge-to-edge bite is not only common but, in my experience, a normal concomitant of growth. A study of the attrition marks in the deciduous teeth will make this clear. In a child of five or six, we find that the overlap of the maxillary incisors has almost, and sometimes completely, disappeared. This can only be caused by a forward movement of the mandible and it is obvious that this movement is not an accidental one, but an essential part of the movements in mastication.

The canines will also show attrition, but the facets on the two

Superior Protrusion
in the
Deciduous Dentition.

Patient aged 6 years
9 months.

(Photo slightly larger than model.)

Illustrating Communication by
Mr. A. T. Pitts.

Superior Protrusion.

Patient aged 6 years
11 months.

Deformity Caused
by
Thumb-sucking.

ANGLE'S CLASS II.

Complicated Cases.

Case No. 1.

Case No. 2.

Illustrating Mr. C. S. Morris's Communication.

sides cannot be made to meet at one and the same time. It is evident that only a lateral movement of the mandible can cause this wear. The first deciduous molars will also show some wear but rarely to the degree of obliterating the cusps, while the second molars even up to the time they are shed are usually only slightly worn. Remembering that the attrition marks are the registration on the teeth of oft-repeated movements of the mandible, we can, to some extent, reconstruct the movements of the jaw by a study of these marks. The conclusion that I have come to is that, in children, the movements of mastication are chiefly in an anterior direction and that lateral movements are subordinate. While I admit that this range of movements is not strictly comparable to that of adult primitive man in whom the lateral movements are well developed, yet in so far as the child still retains the scissors-like action of the front teeth which was evidently an important part of the masticatory movements of ancient man, I think we are justified in regarding mastication in the child as still retaining some primitive features. It is the expression of a tendency toward the primitive edge-to-edge bite in which the tendency is so far successful that, while the edge-to-edge bite is not the anatomical position of rest, it becomes the position of choice and utility.

With the eruption of the permanent teeth a further state in evolution occurs. The alteration in the shape of the glenoid cavity, the increased number of teeth and the consequent increase in the length of the jaw, and possibly a greater development of the pterygoid and temporal muscles, all play their part in directing a change in the movements of the mandible. To discuss these would be beyond the scope of this communication, but it may be worth pointing out that although the development of the *eminentia articularis* would seem to interpose an effective barrier to forward movements of the jaw, yet the adult can protrude the mandible as far forward as the child although habitually we do not make much use of this movement except perhaps as an expression of emotion, as witness the scriptural phrase, "They shoot forward their lips in derision."

Some further evidence of the primitive character of the deciduous teeth may also be found in their anatomical features. The primitive type of the occlusal surface of the first molar; the marked bulge of enamel just above the gingival margin common to all the teeth but especially well-seen in the first molar, is also suggestive. It is a characteristic of the teeth of many of the carnivores where undoubtedly it serves to protect the gum from injury. In Krapina man it is noticeable that the molar teeth are not constricted at the neck as in modern man, so that the circumference at that part is greater than that of the occlusal surface.

These are small points but they have a cumulative effect and warrant the suggestion, I will not put it stronger, that the deciduous dental apparatus retains features once present in primitive man but no longer found in the permanent dental apparatus of modern man.

Variation, as we know, occurs to a considerable extent in all parts of the body, but the maximal and minimal extent of any type of variation must bear some relation to the average. Inferior protrusion considered as a variation of the edge-to-edge bite, is not so extreme a variation from type as to be markedly abnormal. Contrasted with the modern type of occlusion, in which the lower

incisors bite inside the upper, it might seem too extreme a variation to be accounted for on biological grounds. If, however, this hypothesis be accepted that the dental apparatus of modern man still retains some primitive characteristics which appear and play a transiently functional part in the evolution of the teeth and movements of the jaw from childhood to adult life, then we can understand how inferior protrusion can sometimes appear as an atavistic variation from the normal.

There are two further points closely connected with this argument on which I have not been able, so far, to obtain any evidence. The first is the relative frequency of inferior protrusion in primitive man and those races in which an edge-to-edge bite is still normal, as compared with modern man. On *a priori* grounds I should expect it to be a much commoner variation. If this be so it would support my contentions.

The second is the relation of inferior protrusion in the deciduous dentition to that of the permanent dentition. In the case I have shown there is little doubt that the condition will be perpetuated in the permanent dentition. Probably in all similar cases it is the same. Can we conclude that in inferior protrusion of the permanent teeth the relation was the same in the deciduous teeth ?

It is obviously an important point ; in many cases I feel sure that it must be so, though a reliable history supported by models is, doubtless, hard to come by. If this could be shown it would be an additional argument for this theory. I have searched the literature for an answer to this question but the only reference I have found to this point is in Salter's " Dental Surgery and Pathology," published in 1874.* In speaking of the irregularities of the teeth he says: " Irregularities of the temporary teeth are uncommon and are not of much importance. The incisors sometimes have a distorted position, but the commonest form of irregularity in the teeth of the first set is that which is relative in the two jaws. It is not very rare in families where there is a strong tendency to what is known as an ' underhung bite,' for the temporary incisors, or even the canines of the lower jaw, to project beyond those of the upper. And though this may not be attended by any irregularity of the relative position of the teeth in either jaw, it still constitutes a serious irregularity of the teeth as taken collectively."

Salter's clinical accuracy as an observer is well-known and gives to all his statements of fact a seal of reliability.

We may take it as certain that not only had Salter seen cases of inferior protrusion of the deciduous teeth followed by a similar condition in the permanent teeth, but that he even regarded it as common. In the absence of statistics as to the relative frequency of a particular condition, it is almost impossible to estimate its true frequency, and statements as to the effect that a certain condition is common may not amount to more than the impression left on the mind by the occurrence in rapid succession of two or three such cases.

In putting these views before you I am conscious that they are very speculative and may seem very far-fetched. Perhaps you may think that without more evidence I am scarcely justified in suggesting such an hypothesis. In view of our admitted ignorance

* See also *Trans.* Odon. Soc., February, 1879.

of the causes of inferior protrusion, perhaps I may be pardoned for this attempt to provide a clue.

The CHAIRMAN said the Society was very much indebted to Mr. Pitts for bringing forward such interesting cases. He thought there must be underhung cases in the temporary dentition which escaped notice. He thought Mr. Pitts had said that his patient had no history of the " comforter " or thumb-sucking, but it was difficult to imagine how a comforter could be used with such an articulation.

Mr. MAXWELL STEPHENS said perhaps Mr. Pitts would like to look at a model of a child three years and eleven months old with an edge-to-edge bite, a patient of his own. (*Models shown*).

Mr. NORTHCROFT said it might be within the recollection of the members that Mr. Pollit brought forward a case of inferior protrusion in temporary dentition some years ago, and he himself also brought a case forward of a child two years and eleven months old, his youngest orthodontic patient. That child was now fifteen and had a perfect bite, but in the early days she had very marked inferior protrusion of the mandibular teeth and he did not think that it was so very rare.

Mr. MAYER asked whether there was any way of stopping a very young child from sucking its thumb.

The CHAIRMAN pointed out that the old-fashioned method was to try something which would be distasteful to the child, such as quassia applied to the thumb.

The HON. TREASURER asked whether a woollen glove without fingers had been tried.

Mr. LEWIN PAYNE said in his experience the method most successful for the prevention of thumb-sucking had been the insertion of some appliance which covered the palate and removed the satisfaction which the child obtained from sucking the thumb.

Mr. MAXWELL STEPHENS said he had just inserted a plate which achieved that result in a child four years of age. After the plate had been in for about a fortnight the child had ceased to suck its thumb, but there was marked abnormality, and he thought it was the treatment for the abnormality and not so much the treatment for the thumb-sucking which brought about the result.

The CHAIRMAN thought Mr. Pitts' remarks with regard to primitive man were very interesting, that the anterior protrusion was really an exaggeration of the edge-to-edge bite found in primitive man. In the celebrated Piltdown skull the canine tooth was really more the shape of the temporary canine tooth. Those who had opportunities of seeing children's mouths might look for a condition which he had noted in may cases and which really provided an opportunity of finding another primitive condition, a little pouch in the buccal side, the frænum running out from the temporary molar up into the cheek, and, when the child shut the jaws together, if the lips were pulled aside the little pouch could be seen. At one time he collected quite a number of those cases in children, and he considered the thing very suggestive. It reminded one of the pouches used by monkeys for storing food. One would expect the little pouches to disappear after a time, and that was what he found happened. They were very distinct in some children.

Mr. CARL SCHELLING said he had often seen the pouch in adults and its attachments had prevented the cleaning of the buccal surfaces of the second lower bicuspid teeth and led to cervical caries.

The CHAIRMAN said it was found occasionally in the adaptation of artificial dentures, but he was speaking of cases where there was a distinct pouch.

Mr. PITTS said there were two other things in the deciduous teeth which suggested their primitive nature. One was the relatively large size of the pulp chambers and the other was that it was not uncommon to get a partial fusion of the roots, which was found in the teeth of primitive man.

Mr. Pitts showed the models of another case.

Marked Deformity of the Jaws Caused by Thumb-Sucking.

These models are from a girl of ten. As you will see, there is a large gap between the teeth on the right side extending from the second premolar to the left central incisor. The child has always sucked her thumb and still does so at night. The thumb is placed in the mouth on the right side as far as the metacarpo-phalangeal joint with the palmar surface upwards. In view of what Mr. Badcock has told us on other occasions it is interesting to know that she also fumbles with the blanket with the other hand. Adenoids were removed at the age of five, but there is still some nasal obstruction and some marginal gingivitis present. She is being operated on in February for the adenoids, and after that I propose to put in an anti-mouth-breathing apparatus with a view to improving the gingivitis and stopping the habit. After that my treatment will be of an expectant nature. The interesting features of this case are the marked deformity which the habit has produced and the fact that it is not in the middle line. I have seen many deformed jaws but this is the first which has not been median in position.

A Complicated Case of Angle's Class II.

By Mr. C. S. Morris.

This child was just over eight at the time the model was taken in March, 1918. She was an extremely nervous child and I had great difficulty in taking any impression at all. The models were made in war-time under tremendous pressure. It is a post-normal case on both sides with the first permanent lower molar on the left side erupting at an angle. The first thing that strikes one is that she is very under-developed in the premaxillary region. In the lower jaw she has lost her temporary lower canine, and the right lower lateral is in contact with the first temporary molar. On the left side the temporary canine is being squeezed out inwards, and as a matter of fact it was subsequently lost, and the other tooth is rapidly taking up the same sort of position as the right lower lateral. The left lower first molar was damaged in the making of the model, but it has been made up and the make-up will show exactly what the condition was. It was tipping forwards and coming in contact with the internal anterior cusp of the upper molar. It was really causing absorption of the posterior surface of the second temporary molar. One thing which comes out as a result of the contraction in the front is that the roots of the four incisors, particularly the laterals, are converging towards the central line. I thought perhaps this would be a good model of a case on which treatment could be discussed, remembering that the patient is a very nervous child. The bite is post-normal, with the first molar on the left lower side tilting forwards.

The Chairman asked if the case had been treated.

Mr. Morris said the treatment had been started but he would like to hear what the members had to say before he said anything about that.

Mr. H. Chapman asked what was the physical condition of the child—was she *petite?*

Mr. MORRIS said the condition was to a certain extent hereditary. Her father had a markedly contracted arch and a post-normal bite and had something of the same arrangement in the front of his mouth as his daughter, but not nearly so prominent. The child had had adenoids, which were removed three years before the models were taken, and she had become considerably more robust; she was a delicate child but was picking up considerably, although she could not be called a robust child now. He would not say she was under-developed, but she was frail, and distinctly small and narrow in her features.

Mr. H. CHAPMAN said it was only the previous week at the London Hospital that he had a patient, aged nine years, not with the same type of irregularity but there was a similarity as regarded the exclusion of the canines from the arch. The child was very *petite;* she had small, delicate features and was in addition small in every way. He noticed that the same description would not apply to the mother of that child, and he asked her how it was, and it came out that the child was the eleventh child of the family; probably that had some bearing on the child's physical condition. He thereupon decided that it would be better to treat the case by extraction of the four first premolars rather than by expansion. From the description of the case given by Mr. Morris he thought he might treat the case under discussion in the same way, although he regarded it as an axiom not to remove any lower teeth in post-normal cases. If the upper canines were removed at once he thought the laterals would fall into much better position and probably rotate themselves without any appliances. He felt this was a case that required more consideration than could be given in the time available before deciding on a definite line of treatment.

Mr. MORRIS said he had another case which had long passed the time at which it was generally considered any treatment was possible. The model was taken in 1906, but it might be of interest, because orthodontists changed their ideas as they became older. It was an Angle Class II, Division II. case. The child was fourteen when the models were taken in September, 1906. In the upper jaw the right lateral was almost in contact with the right first premolar. The point of the canine was just showing above the posterior external angle of the lateral. On the right lower side evidently the first premolar had been removed some time previously, and the right lower canine was falling back and crowding out the first lower premolar. The front teeth were overlapping and on the left side in the upper jaw the canine was attempting to come into position earlier than the one on the right side, so that the lateral had been fixed forward to a certain extent. Evidently she had lost her first temporary molar some time previously, and the first and second premolar and the first molar were markedly leaning forward, so that relatively she had a very post-normal bite. In the lower jaw on the left side the canine was falling backward and the first lower premolar was coming up and preventing any further falling back. The second premolar was caught under the anterior surface of the molar. One thing that complicated the case considerably was the fact that the first molar on the left side was devitalised, and he discovered afterwards that she had a sinus running up the anterior external angle, through which a fine probe could be passed to the apex, and with a little pressure on the gum a certain amount of pus could be obtained. She was markedly short in her lower jaw. He had described her condition to her mother at the time as having a bite very much like a frog. He had hardly ever seen anybody whose lower jaw seemed to disappear underneath her upper jaw to such an extent as in that patient. Her expression was very unhappy, so that he had to do something for the case, not only to get a reasonable occlusion but to make her present as good an appearance as possible under the circumstances.

Mr. BADCOCK, referring to the first case shown by Mr. Morris, said

he would like to ask a question on general principles. He had been much surprised at the remarks of Mr. Chapman, who said that in certain cases of post-normal occlusion he would extract premolars. He could not see that it could ever be justified or how a case could be corrected in that way. It seemed to him that, having extracted such teeth from both the jaws, the relation between the two would remain precisely where it was, and that it was a case that might be called Class II, Division 2. The reason why the upper teeth in such cases were bunched was, he thought, that owing to the backward position of the lower arch, the upper lip pressed the upper teeth against the lower teeth and so crowded them. If the sizes of the arches were equally reduced, would not the same thing happen ? How could the upper teeth remain straight ? A considerable space must exist between the upper arch and the lower arch. The upper teeth could not rest against the lower teeth unless they were crowded on to them, and if they were not crowded on to them it seemed to him the condition could not be stable.

Mr. Morris said with regard to the treatment of his second case he did not think he would have treated it to-day in the way it was treated fourteen years ago, when he was full of enthusiasm for Angle's arches and that kind of thing. He thought they were very useful but he did not find the same amount of use for them to-day as he found then. The patient had a very short mandible from above downwards, and he wanted to improve her appearance, and therefore he put on arches and put in a biting plate. He expanded the upper arch, pushed the teeth back on the left side and expanded them on the right, because the first and second premolars were not slanting forward, and then put on intermaxillary traction, with the idea that when he got the bite into normal occlusion he might put in something in the nature of a substitute for the lower first left molar. The centre lines were not right, so that when it came to intermaxillary traction he did not succeed in restoring normal occlusion on the left side, but got a very good result and obtained that result within two years, seeing the case pretty frequently. The patient wore light intermaxillary elastics to maintain normal occlusion for about eighteen months, and then she was taken to South Africa. An accident happened and the apparatus was broken and there was nobody to attend to it, but she maintained her normal occlusion on the right side, although on the left side it went back half the distance. Her personal appearance was markedly improved, so much so that her father sent him many a good patient afterwards. Another case he had, not quite a year younger, was one in which he had to maintain retention elastics for three and a half years after the completion of the case. Every time the elastics were left off the tendency was for the articulation to become post-normal again. With regard to the first case, he did not take out the first premolars all round. He was rather inclined to agree with Mr. Badcock when he said that the relation of the jaws would be left very much in the same condition as it was before. He had had a case come to him in which an enterprising person had extracted at the age of eighteen the premolars, and at the age of twenty-two the patient came to him to see what he could do for her, and the only thing he could do under the circumstances was to take out two more, and it proved a great success. In the first case he had shown, to take out premolars he thought would simply produce the condition she was in now, and he determined to put in a crib with Mr. Visick's bulldog grips. The lower teeth were pushed forward and space made for the canines, and at the present moment the premolars were in position. In the upper jaw he did what he always did. Nothing would induce him to start and move the jaws all over the place ; he went in for removing the teeth rather than moving the jaws, and in that case he took out the temporary canines, and the laterals started to fall in. As soon as he saw any cramping of the laterals he took out the first temporary molars. He made room below

by putting finger springs—following Mr. Chapman—on to a Jackson crib plate. At the present time the patient was almost in normal occlusion. He did not expand the upper jaw at all but expanded the lower forward only. He might say that it was not normal occlusion but post-normal occlusion with the teeth in proper relationship in that condition.

A Modification of the Jackson Crib.

By Mr. J. W. Mayer.

This is not a new idea but it has been so useful in practice that I thought I might show it to-night in the hope that it might help somebody out of a difficulty. It is particularly applicable in cases where the interdigitation is so marked that in using the ordinary Jackson crib the strut which goes between the occlusal surfaces is bitten on and the plate becomes loose and useless. This model shows that one side has been bitten out and the retention is spoiled and the plate comes down in the mouth. I daresay most members have found that that has happened at some time or other. In order to get over this Mr. Brown devised a crib made in the way shown on this model. There are no struts going between the occlusal surfaces, and the bite is not interfered with at all. I have used it in many cases and I have found that the patient can wear it quite comfortably and the plate keeps up very well indeed.

I have here another model showing the construction. The large piece of metal going behind the last tooth is cast and there are little pieces of metal fixed round the necks of the teeth, each fitted separately and tapped together, and the whole apparatus is vulcanised into the plate. If by any chance it should be considered objectionable to have the reinforcing spur in the front, it can be further modified by bringing the large piece of metal further round and soldering the little spurs on to it. Both methods are equally satisfactory.

The Chairman, in opening the discussion, said that in the first model the lower canines were absent and there was a little space. He thought the second model provided another alternative.

Mr. H. Chapman said he was particularly interested in the Communication, because he had been using finger springs, attached to the Jackson crib which went round the teeth in the ordinary way, for moving the teeth in much the same manner as Mr. Friel had attached the very flexible finger springs to the labial and lingual arches of the fixed type. He had used these finger springs with vulcanite plates attached as just mentioned and found them very effective. He thought the idea of Mr. Meyer for fixing clasps would also serve admirably for fixing these small gauge finger springs. He has been immensely pleased with the work that they did.

Mr. H. C. Highton asked if the second arrangement was cast as a whole piece.

Mr. Mayer said only the stouter part. The other part was just fitted round the neck.

Mr. H. Chapman asked what the stout metal was compose of.

Mr. Mayer said in the case under discussion it was silver, but generally gold was used, the gold being recovered afterwards from the patient.

Mr. Morris asked whether the apparatus interfered with the bite of the lower teeth as it came over in the front of the canine. In one of the cases one of the teeth was lost, but he imagined that in a normal case it would bite against the part of the crib coming down under the lower teeth.

Mr. MAYER said that as a matter of fact that case was rather an unfortunate one, because the lower canine was missing. It was generally possible to get between the lateral and canine.

The HON. SECRETARY read the President's valedictory address.

It is with the profoundest regret that I am unable to be present with you this evening for the concluding meeting of the session in which you have honoured me with the Presidency of your Society.

During the year the Society has resumed to the full its usual pre-war junctions, and we have enjoyed a series of admirable papers and communications varied by a demonstration evening, and a clinical evening with cases for diagnosis. These have all provided good material for profitable discussion.

During the year the Council has appointed a Museum Committee and decided to invite from members the contribution of models and other data of cases which show the results of treatment not less than two years after all retaining appliances have been removed. We may hope that during the next twelve months some progress may be made in collecting and reporting on such cases. A generalised report on even half a dozen such cases would afford excellent material for discussion at one of the ordinary meetings of the Society and would present to us an aspect of our subject which has been too little studied. Innumerable are the books which have been written to illustrate human knowledge and human learning, but there is still no adequate treatise on the phenomenology of human error. Numerous too are the books, articles and papers which have been written on many aspects of orthodontic practice but there is still no generalised study of the relapses which take place after treatment, and yet such a study might be of immense value for practice and save many of us from recapitulating the mistakes of our predecessors. A museum which collects material for such a study would be serving the highest function of a museum, the function of research as distinguished from the display of material illustrating knowledge of which we are well assured, and here is an ample untilled field for our activities which in return for comparatively little cultivation may be well expected to provide a rich harvest. I look forward to this being well evidenced during the coming year.

It now remains for me to return you my sincere thanks for the whole-hearted support and sincere goodwill you have showed me all through my term of office. I shall long look back to the year which has now elapsed as a year to me of great pleasure and great profit in the associations which have linked me so closely and so happily with you all.

It is an added disappointment to me that I cannot be present in person to welcome Mr. Payne to the chair. He needs no introduction to you from me. Under his leadership the Society is well assured of a successful year in every way, and for myself I express to him the sincere hope that his year of office may prove as pleasant and profitable to him as mine has been to me.

The CHAIRMAN thought it would be the wish of the meeting that the Hon. Secretary be asked to convey to Mr. Campion the thanks of the Society for his valedictory address and an expression of their hope that by the time he received the letter he would have recovered his health.

The CHAIRMAN then inducted into the Chair the new President, Mr. J. Lewin Payne.

The PRESIDENT said he was very deeply sensible of the honour which had been conferred upon him by his being asked to occupy the Presidential Chair. He felt specially grateful to be welcomed by such a prominent member of the profession as his old friend Mr. Sidney Spokes. His only regret was that he had done so little to deserve the honour, but he would do his best during the coming year to serve the Society,

and with the aid of the indefatigable Secretary, Mr. Chapman, who did the lion's share of the work of the meetings, he hoped 1921 would be a very successful year.

On the proposition of Mr. NORTHCROFT a hearty vote of thanks was accorded to Mr. Sidney Spokes for occupying the Chair that evening.

The thanks of the Society were accorded to Mr. Mayer, Mr. Morris and Mr. Pitts for their Communications.

THE CURATOR AND LIBRARIAN'S REPORT.

During the war the Museum and Library naturally remained in *statu quo*, but now I have to report that this session your Council has appointed a special Museum Committee.

This is endeavouring to acquire a series of models, particularly of completed cases which have not received treatment for three years following the removal of retainers. The Committee hopes that this will give material for the investigation of the dental arch.

The difficulty of obtaining models of such cases is obvious to most of us, but I take this opportunity of calling attention to the fact that an immense amount of material is lost to the Museum for want of members providing convenient boxes in which to store their models. Let me implore them therefore to obtain cardboard boxes for the purpose; these keep the models in good condition, intact, and as a series allow the progress of the cases to be surveyed.

B. B. MAXWELL STEPHENS.

Messrs. LAKE and MAXWELL STEPHENS were elected Auditors for the ensuing twelve months.

HON. TREASURER'S REPORT.

The HON. TREASURER, in presenting the statement of accounts from December 1st, 1919, to December 30th, 1920, said the income of the Society amounted to £108 6*s*. 2*d*. and the expenditure was £77 9*s*. The available bank balance was £37 2*s* 8*d*., in addition to which amount the Society had £150 invested in 5¾ per cent. Exchequer Bonds.

The CHAIRMAN said the balance sheet and statement of accounts had been audited by Mr. A. R. Colyer and Mr. Bertram Samuel, and there were vouchers for the securities held by the bank, the Exchequer Bonds. The balance sheet and statement of accounts were open to inspection by any member of the Society who desired to do so.

Mr. GEORGE NORTHCROFT drew the attention of the Council to the possibility of using the surplus funds wisely. He did not think it was necessary for the Society to keep a large amount of money invested and it would therefore be wise for the Council to consider the establishment of some small scholarship or prize or something of that kind, so that the money might be used. He was not aware of any members having fallen in the war but, if there had been, some memorial might be instituted.

The CHAIRMAN said the disposal of the surplus money had been under consideration, and a Committee had been appointed to consider the possibility of drawing up a scheme by which certain prizes might be awarded. It was carefully considered by the Council, but in the end the Council decided that they would not act upon those recommendations of the Committee. It was thought that perhaps the best way to spend the money was in the direction of a museum, which would be something permanent in connection with the Society. There was a suggestion book if any member wished to suggest anything on the subject.

On the motion of Mr. GEORGE NORTHCROFT, seconded by Mr. GOLDIE, the report of the Hon. Treasurer was adopted.

On the motion of Mr. J. H. BADCOCK, duly seconded, the report was adopted.

The Hon. Secretary read the following report:

Hon. Secretary's Report.

I will make my report very brief as there are several interesting communications on the agenda this evening.

Seven meetings have been held during the year; these have been on similar lines to those held in previous years, except the last, at which patients were present; it was not expected these would have been under treatment and in future one hopes that the cases will give no indication of what treatment might be.

Another meeting of this kind will be held in 1921.

As shown in past balance sheets, the Society has a balance in hand, and early in the year a Prizes Committee was appointed by your Council to consider means for increasing the membership and whether prizes for Orthodontics should be offered to Dental Schools. The report was not accepted, but the following resolution was carried:

> "That the Prizes Committee be enlarged and be requested to consider the desirability and possibility of forming a Museum of treated cases, with a provision that any cases shown should exhibit the final result not less than two years after all retaining apparatus has been removed."

The Committee consists of Messrs. Campion, Northcroft, Samuel, Maxwell Stephens and Chapman. The Committee has met several times and has awaiting its consideration several sets of models as prescribed by the terms of reference. These models have been loaned or given by members, at the request of the Committee. The Committee will report its findings later to the Society.

The Society has been requested to join the Federation of Medical and Allied Societies. The Council, after due consideration, decided that it is *ultra vires* for this Society to join the Federation, but desired that members should know that they may join as individuals.

The Council has decided to hold the meetings next year on the third Monday in January, second Wednesday in February and March, second Monday in May, and the first Monday in October, November and December.

The membership of the Society continues to grow. Thirteen new members have been elected this year, including those to be voted for this evening, and five have resigned. The total membership is now: ordinary members, 100; corresponding members, 3; honorary member, 1.

(Signed) Harold Chapman.

The Hon. Secretary said the Council had decided to hold the meetings next year on the third Monday in January, the 17th, the second Wednesday in February and March, the 9th of both months, and the second Monday in May, also the 9th, and on the first Monday in October, the 3rd, November the 7th, and December the 5th. He asked the members to note that the dates for 1921 in Bale's Diary were not correct, except for February and March.

On the proposition of Mr. Goldie, seconded by Mr. McMahon, the report was adopted.

THE BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS.

STATEMENT OF ACCOUNTS from December 1st, 1919, to November 30th, 1920.

1918-1919. £ s. d.	RECEIPTS.	1919-1920. £ s. d.
	To balance brought from last account :—	
163 16 7	Cash at Bank	156 5 6
5 12 0	Interest on Exchequer Bonds	5 9 4
0 11 3½	Cash in hand	0 7 3
60 18 0	Subscriptions received during year ...	102 16 10
£230 17 10½		£264 18 11

1918-1919. £ s. d.	PAYMENTS.	1919-1920. £ s. d.
7 7 0	By Rent	15 15 0
2 17 9	Printing and Stationery	15 10 0
	By Reporting	19 19 0
	By Hire of Epidiascope	7 7 0
	By Refreshments	8 7 6
2 6 10	Postage, 'Phone and Sundry Expenses	9 9 6
£12 11 7		£76 8 0
60 18 0	Subscriptions Remitted	1 1 0
£73 9 7		£77 9 0
	Balances carried to next account :—	
150 0 0	Exchequer Bonds	150 0 0
6 5 6	Cash at Bank	37 2 8
1 2 9½	Cash in hand—Hon. Treasurer ...	0 7 3
£230 17 10½		£264 18 11

We have examined the Books and Vouchers and certify the above Statement of Accounts to be correct.

(Signed) ARTHUR R. COLYER
BERTRAM SAMUEL.
Hon. Auditors.

List of Members, May 1st, 1921.

ORDINARY AND CORRESPONDING MEMBERS.

Aubrey, H. P., 40, Curzon Street, Mayfair, W.1.

Badcock, G. W., 32, Brunswick Place, Hove.
Badcock, J. H., 140, Harley Street, W.
Baldwin, Sir H., 37, Cavendish Square, W.1.
Barrett, Russell, 41, Harley Street, W.1.
Bascombe, E. D., Melford Lodge, Bourne Avenue, The Square, Bournemouth.
Bennett, F. J., 23, Grosvenor Street, W.1.
Bennett, Norman G., 50, Brook Street, W.1.
Blaaberg, C. J., 29, Queen Anne Street, W.1.
Bowes, J. A., 28, South Side, Clapham Common, S.W.
Briault, E. H. L., 145, Finchley Road, N.W.
Bryan, Hermann, 26, St. Giles's Street, Norwich.
Bull, F. B., 58, Wimpole Street, W.1.
Byron, J. L., 213, North End Road, Kensington, W.14.

Calder Edward, King Edward St., Potchefstroom, Transvaal (Corresponding Member).
Campion, G. G., 264, Oxford Road, Manchester.
Campkin, Hugh T., 71, Harley Street, W.1.
Chapman, Harold, 15, Upper Wimpole Street, W.1.
Clarence, Thomas H., 24, Upper Wimpole St., W.1.
Clogg, Arthur H., Rockmount, 128, Church Road, Upper Norwood, S.E.19.
Colyer, Arthur R., 19, Upper Wimpole St., W.1.
Commander, Eric N., 11, Aldergate, Tamworth.
Crane, Walter A., Melford Lodge, Bourne Avenue, The Square, Bournemouth.
Cribb, H. E., 15, Stratford Place, W.

Denham, N., 29, Albemarle Road, Beckenham.
Doherty, J. W., 140, Harley Street, W.1.
Doubleday, F. N., 48, Welbeck Street, W.1.
Dowsett, E. B., 118, Gloucester Place, Portman Square, W.1.
Dreyfus, S., Grand Pont, Lausanne, Switzerland. (Corresponding Member.)

Eady, Barrington, 29, Devonshire Place, W.1.
Edey, G. Russell, 153, High Street, Bromley.
Edgar, N., 39, London Road, Enfield.

Farmer, F. M. (Sir), St. Winifred's, Hampton, Middlesex.
Fernie, J. G.,Holmleigh, Murray Road., Northwood Middlesex.
Friel, Sheldon, 3, Fitzwilliam Place, Dublin.
Fry, W. Kelsey, Guy's Hospital, S.E.1.

Gardner, Stanley M., 24, Upper Wimpole St., W.1.
Garrow, A., 115, Harley Street, W.1.
Goldie, George J., 14, Upper Wimpole Street, W.
Grayson, J. Kenneth, Mount Pleasant, Turner's Hill, Cheshunt, Herts.
Green, W., South View, 10, North Common Road, Ealing, W.

Hammell, D. H., 19, Upper Wimpole Street, W.1.
Henry, C. J., 78-79, King William Street, E.C.4.
Henry, P. F., 79, King William Street, E.C.
Highton, Herbert C., 17, Harley Street, W.1.
Hopson, Montagu, F., 7, Harley Street, W.1.
Housden, C. H., Thurnby, Jenner Road, Guildford.

James, W. W., 2, Park Crescent, Portland Pl., W.1.
Jeffery, Louis, 1, Newton Villas, Finsbury Park, N.
Johnson, Arthur W., 71, Grosvenor Street, W.1.
Johnson, Gordon, 46, Lee Terrace, Blackheath, S.E.
Jones, Wm., 2, Colosseum Terrace, N.W.
Jones H. Llewelyn, 9, Harley Street, W.1.

Knaggs, S. A., 21, Rosslyn Hill, Hampstead, N.W.
Knowles, C. Heygate, 15, Worsley Road, Hampstead, N.W.

Lacey, A. G., 9, Harley Street, W.1.
Lake, Carol P., 14, High Street, Windsor.
Lawrence, F., 35, Brompton Road, S.W.3.
Leyton, G., 12, rue Belliard, Bruxelles (Corresponding Member).
Lees, C., Breifond, Boyne Road, Tunbridge Wells
Lockett, A. C., Hereford House, 117, Park St., W.1.

McBride, John, 26, Duke's Avenue, Muswell Hill, N.
McKeag, H. T. A., 33, College Gardens, Belfast.
McKechnie, J. D., 29, Queen Anne Street, W.
McMahon, G. E., Connaught House, Beckenham, Kent.
Malleson, H. C., 30, Thurlow Rd., Hampstead, N. W
Marsh, H. E., 1, Cantelupe Road, Bexhill, Sussex.
Mason, E. N., Sandown, 306, Broadway, Bexley Heath.
Matthews, G. F. Cale, 60, Newhall St., Birmingham
May, W. J., 24, Upper Wimpole Street, W.1.
Mayer, J. W., Stedham House, Surbiton Hill.
Mellersh, W. Francis, 9, Harley Street, W.1.
Mendleson, B., 53, Queen Anne Street, W.1.
Messenger, H. L., 47 Rosslyn Hill, N.W.3.
Morris, C. S., 88, Park Street, W.1.
Morris, L. F., West Moor, Poole Road, Bournemouth.

Northcroft, George 115, Harley Street, W.1.

Parfitt, J.B., 179, King's Road, Reading.
Pavitt, P. G., 57A, Wimpole Street, W.1.
Payne, J. L., 18, Portland Place, W.1.
Pearce, F. J., 57A, Wimpole Street. W.1.
Phillips, Edward, 1, Frognal, N.W.3.
Philpotts, Montague, 14, High Street, Windsor.
Pitt, Edward, Brandhoek, Gerrard's Cross, Bucks.
Pitts, A. T., 22, Wimpole Street, W.1.
Pollitt, G. Paton, 50, Brook Street, Hanover Square, W.1.
Pritchard, Geo. B., 18, Portland Place, W.1.

Rilot, Chas. F., 22, Wimpole Street, W.1.
Roe, Samuel H., 60, Newhall Street, Birmingham.
Rowlett, A. E., 165, London Road, Leicester.
Rushton, W., 32, Harley Street, W.1.

Samuel, Bertram B., 76, Wimpole Street, W.1.
Schelling, C., 37, Cavendish Square, W.1.
Scott, P., 42, Devonshire St , Portland Place, W.1.
Shore, H. D., 4, Seymour Street, W.1.
Spiller, J. E., 62, Worple Road, Wimbledon.
Spokes, P. Sidney, 4, Portland Place, W.
Steadman, Sydney Francis St. Jermain, 9, Welbeck Street, W.1.
Stephens, B. Maxwell, 76, Grosvenor Street, Grosvenor Square, W.1.
Sturridge, Ernest, 29A, Wimpole Street, W.

Tattersall, Harold, 1, Sandwell Mansions, N.W.
Tebbutt, E. Spencer, 30, Finsbury Square, E.C.2.
Thew, W., 140, Harley Street, W.1.
Thomson, George, 38, Harley Street, W.1.
Toit, J. J. du, 11, Leenvenovet Rd., Tambverskloof, Cape Town.
Turner, J. G., 59, Wimpole Street, W.1.
Turner, V. E., Prince of Wales Road, Norwich.

Visick, Hedley, The Wolds, College Road, Eastbourne.

Wallace, Dr. J. Sim, 150, Harley Street, W.1.
Winderling, Prof. Aldo Maggioni, Via Manzoni 45, Milan, Italy (Corresponding Member).
Wood, Bryan J., 7, London Road, Kettering.

HONORARY MEMBERS.

Bogue, E. A., 63, West 48th St., New York, U.S.A.
Keith, Prof. Sir A., Royal College of Surgeons, W.C.1

The Botolph Printing Works, 8, Gate Street, Kingsway, W.C.2.